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red tide

Every so often, for some reason or combination of reasons, a variety of nanoplankton of the dinoflagellate type, start reproducing wildly. The "nanoplankton" embraces varieties less than five microns in diameter; they're small. For years they slipped through the fine-meshed nets marine biologists used in collecting plankton, and were thought to be rare and unimportant. They're not unimportant; when they go into one of those population explosions, quintillions of the wee beasts build up a high population density. Their metabolic wastes aren't particularly toxic under normal conditions—but when that immense population, in a high density, starts living in the sea—practically everything else dies. And, of course, they die too, presently, for no organism can live in a medium of its own by-products.

The resultant "red tide"—the seas are tainted red with their immense numbers—kills millions of

fish, and Florida in particular has a serious health problem. Millions of dead fish on the beaches and in the shore waters give off their own form of toxins. Despite the herculean efforts of pelicans, gulls, and assorted shore creatures, the garbage disposal division of the ecology gets overloaded.

It isn't that the dinoflagellates are particularly poisonous; they aren't. They live normally in harmony with all the other forms of sea life; it's only when they undergo the population explosion that such a high density of the algae overloads the living zone with by-products.

A great deal has been said and written about the human population explosion—and currently a lot is being said about pollution control. But it hasn't been adequately pointed out that the two problems are intimately and directly related.

When our ancestors settled in America, and first started building

their homes in the primeval woodlands, they dumped all their sewage in the local streams, and they had no pollution problems. Somewhat later, as villages grew up, they started using outhouses and cess pools, and had no troubles.

Well, if it was good enough for grandpaw, how come it ain't good enough for grandson?

Partly because our Colonial Period great-great-grandfathers had ten children, who had eight or nine kids each, who had . . .

It isn't a different kind of problem—it's just a much greater density that makes the trouble. Like the phytoplankton red tide, it's the density, not the organism, that causes the trouble.

Conservationists and pollution fighters talk in terms of pollution by industrial sources. They're worried about the by-products of the metabolism of a human society—which would cause no trouble at all, if the quantity weren't so immense. And the quantity is immense solely because there are too many living human beings.

Usually the problem of population explosion is discussed in terms of the starvation of the immense numbers because it's impossible to grow enough food. The anti-Malthusians answer that improving technology will solve that problem by growing more food.

One of the most important—if not the most important—causes of

the death and destruction of lakes and ponds, the killing off of fish in streams, is mankind's oldest industry—farming.

Plant forms, particularly the algae, are limited in their growth by numerous factors—predators such as herbivorous marine animals do a fine job of keeping the population down under normal conditions. But there is a much more fundamental limitation on their growth—starvation. It's a bit hard to realize that an algal life form, that synthesizes its metabolic needs from the seawater it floats in, carbon dioxide and sunlight, can suffer starvation—but they do.

The area of the earth's seas that has the densest population of living things is *not* in the tropics. The tropic seas are practically deserts. Far and away the most life-filled waters are the antarctic seas, and the great ocean currents, leading from the antarctic, such as the famed Humboldt Current, off the west coast of South America. Those waters teem with life.

All food chains on Earth start with photosynthesizers, the plant forms that can trap solar radiation and build up fats, starches and proteins, and give off oxygen. Animal life can live where there are plants to support it. And where herbivores thrive, carnivores cluster.

The plant forms thrive best in the icy waters of the antarctic—which sounds insane. In the coldest

waters of the planet, where sunlight is, at the very best, dilute, and totally missing for weeks at a time, *there* is the best place for marine plants?

It is, because there they don't starve for minerals.

All life forms on Earth depend on that complex molecule adenosine triphosphate for their energy-transfer needs. Plants use chlorophyll to trap solar energy, and transfer it to adenosine triphosphate, which then transfers it to complex proteins to build starches and sugars and fats. Adenosine triphosphate is one molecule that no living cell on Earth can exist without.

And not even plants can synthesize phosphorous atoms. They've got to have *mineral phosphate*—or drop dead. Abundant CO₂, water nitrogen, sunlight, and all the other minerals of seawater are useless without phosphate.

The difficulty is that mineral-rich seawater tends to be denser than mineral-poor water—it tends to sink toward the bottom. Moreover, bottom water everywhere in the oceans is cold, because water reaches its maximum density at about 4°C. Once chilled to that temperature, it sinks, and stays sunk because the top water, which is warmer, acts as an insulating blanket to keep it cold. In the tropics, the blazing sun can't warm the deep waters—which hold the life-necessary minerals.

So the tropic seas are deserts.

But in the antarctic seas, the top water gets cold—colder even than the 4° bottom water—as the polar winds drive it toward freezing. The frigid top water is now not appreciably different in density from the deep water. This, plus strong currents, causes mixing that brings the mineral-rich waters up from the deep realm of eternal darkness into the upper realm of the polar half-light.

The polar seas swarm with life like no others.

It's been some time now since men discovered that putting phosphate and nitrate materials on their fields would cause their crops to grow faster, better, and produce more food. A large part of the technology that has made it possible to support that ever-increasing population of human beings is the technology of fertilizers.

The only trouble is, the rains that make crops possible also wash out the fertilizer molecules, into the lakes, ponds and streams where the algae have, all these ages, been living on the brink of mineral starvation.

A sort of red tide effect sets in. Algae are plants, oxygen producers; it seems impossible that they should kill fish by oxygen starvation when they start growing wildly—but they do. In part, it's algal by-products that become toxic in high concentrations made possible by fertilizers. But in large measure

it's because algae aren't immortal as individuals—only as a species. Billions die and leave trillions of descendants which die and leave qua-drillions of cells which . . .

The dead algae sink out of the sunlight, and assorted bacteria start carrying out their garbage disposal role. But these bacteria, in consuming the dead algae, consume oxygen. Most of the oxygen the algae produce while living escapes into the atmosphere; the gas isn't very soluble in the relatively warm water of ponds and rivers. Presently the consumption of dead algae has used up all the available oxygen—and the fish start dying.

Now when oxygen-consuming bacteria ferment organic wastes, the odor produced, as various gases escape, is quite mild and not annoying—about like fresh dish-water. But when the supply of oxygen is exhausted, a different crew of bacteria moves in—the anaerobes. They don't need elemental oxygen; they can use the oxygen in H_2O , which is a neat trick, but noisome. They're the ones that make a stinking swamp stink.

Adding to the problem of agricultural fertilizer runoff is the runoff of sewage containing modern detergents. Oh, they're biodegradable now, of course—but just about the most effective of all detergent formulations requires phosphates. Calcium pyrophosphate, for instance, is the basis for a detergent that will clean glass-

"Sf has not been looked at so significantly since Kingsley Amis's *New Maps of Hell*."

—Samuel R. Delany

Lois and Stephen Rose probe the crisis of our time by examining science fiction's approaches to it. Among the sf writers they evaluate are Asimov, Clarke, Heinlein, Sturgeon, Wells, Lewis, Ballard, and Zelazny.

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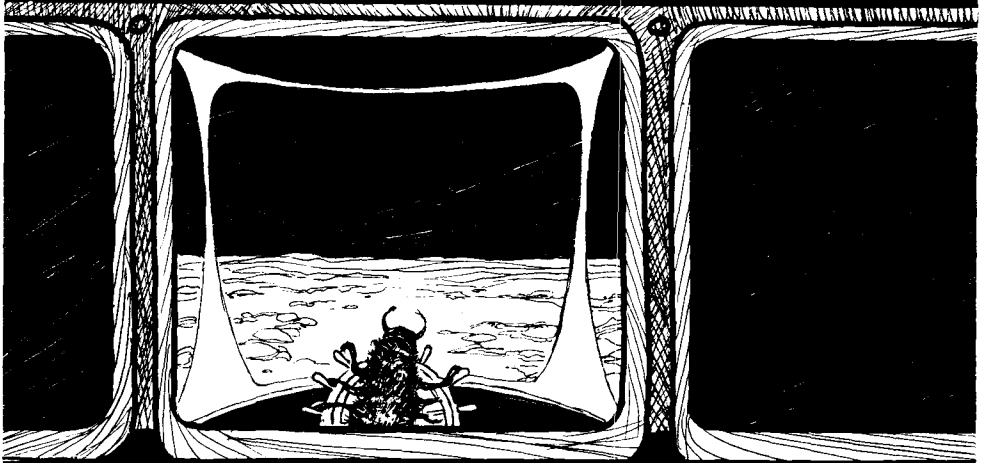
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ware sparkling clean, even in extremely hard water, where ordinary dishwasher detergents leave cloudy spots and streaks. The laundry comes out white and sparkling, thanks to complex phosphates. You'd be surprised how really potent a good household laundry detergent is; try soaking a piece of greasy, painted machinery in a bucket of hot water and your wife's laundry detergent. It'll take the grease off beautifully—and the paint will come off in sheets, too. And the steel won't be corroded in the slightest, of course; they're strongly alkaline, and steel won't rust in alkali.

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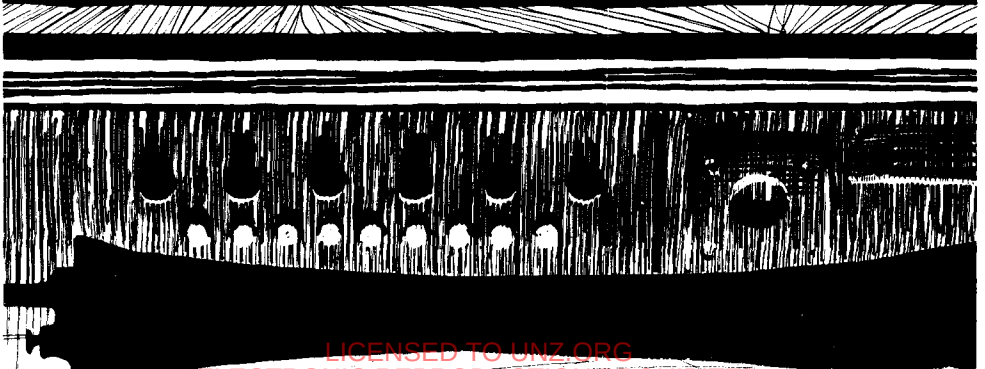


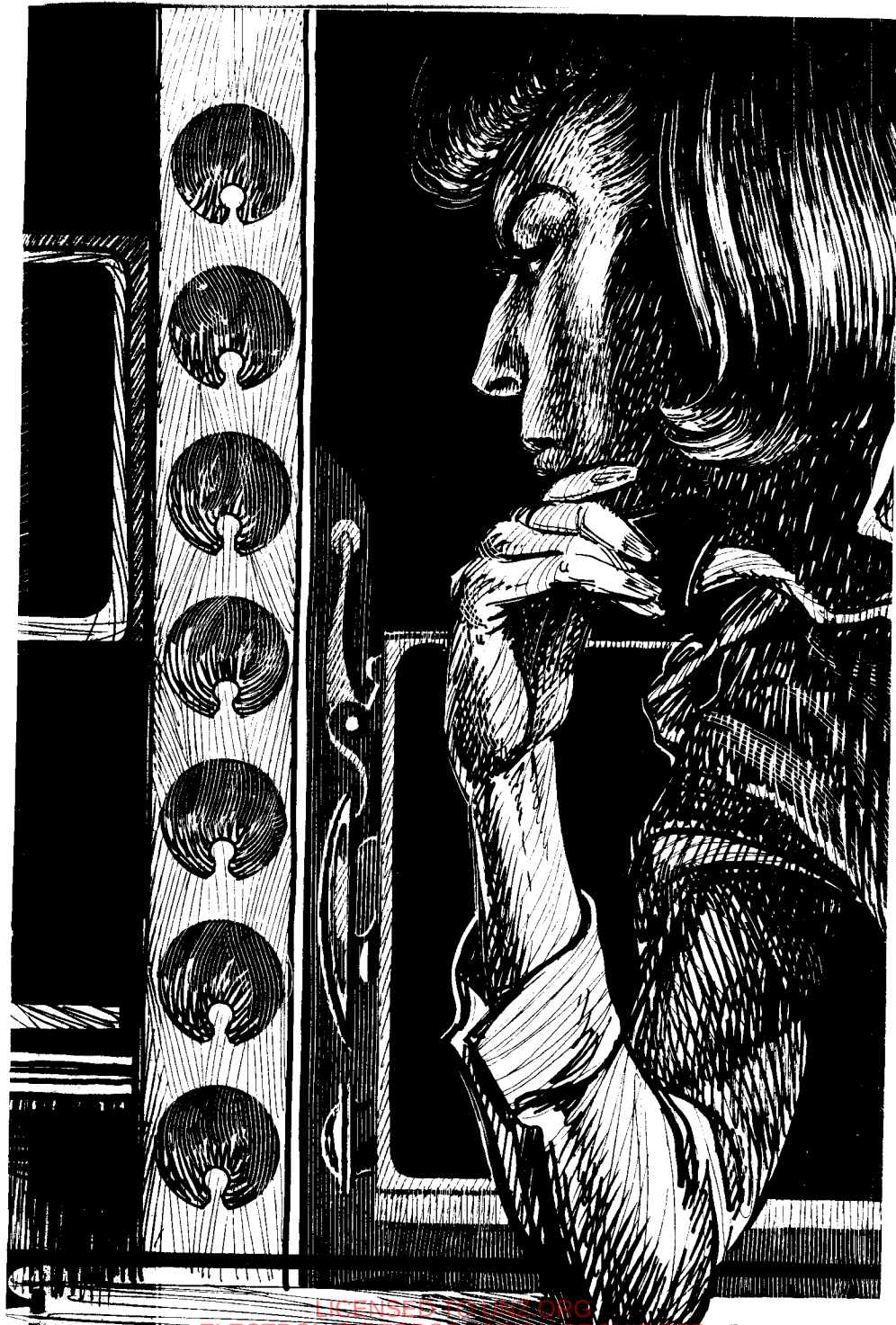
star light

First of Four Parts. Barlennan, hero of "Mission of Gravity," is back—on a "low-gravity" planet. Only 40 G's, a mere tenth of his native 400 G's! But since no other intelligent race known could have studied that vicious planet—the Mesklinites were hired to do it.

HAL CLEMENT

Illustrated by Kelly Freas





Beetchermarlf felt the vibrations die out as his vehicle came to a halt, but instinctively looked outside before releasing the *Kwembly's* helm. It was wasted effort, of course. The sun—or rather, the body he was trying to think of as *the sun*—had set nearly twenty hours before. The sky was still too bright for stars to be seen, but not bright enough to show details on the almost featureless dust “snowfield” around him. Behind, which was the only direction he could not see from the center of the bridge, the *Kwembly's* trail might have provided some visual reference; but from his post at the helm there was no clue to his speed.

The captain, stretched out on his platform above and behind the helmsman, interpreted correctly the latter's raised head. If he was amused, he concealed the fact. With nearly two human lifetimes spent on Mesklin's unpredictable oceans he had never learned to like uncertainty—merely to live with it. Commanding a “vessel” he did not fully understand, traveling on land instead of sea, and knowing that his home world was over three parsecs away did nothing to bolster his own self-confidence, and he sympathized fully with the youngster's lack of it.

“We're stopped, Helmsman. Secure, and start your hundred-hour

maintenance check. We'll stay here for ten hours.”

“Yes, sir.” Beetchermarlf slipped the helm into its locking notch. A glance at the clock told him that over an hour of his watch remained, so he began checking the cables which connected the steering bar with the *Kwembly's* forward trucks.

The lines were visible enough, since no effort had been made to conceal essential machinery behind walls. The builders of the huge vehicle and her eleven sister “ships” had not been concerned with appearance. It took only a few seconds to make sure that the few inches of cable above the bridge deck were still free of wear. The helmsman gestured an “all well” to the captain, rapped on the deck for clearance, waited for acknowledgment from below, opened the starboard trap and vanished down the ramp to continue his inspection.

Dondragmer watched him go with no great concern. His worries were elsewhere, and the helmsman was a dependable sailor. He put the steering problem from his mind for the moment, and reared the front portion of his eighteen-inch body upward until his head was level with the speaking tubes. A sirenlike wail which could have been heard over one of Mesklin's typhoons and was almost ridiculous in the silence of Dhrawn's snowfield secured the attention of the rest of the crew.

"This is the captain. Ten hours halt for maintenance check, watch on duty get started. Research personnel follow your usual routine, being sure to check with the bridge before going outside. No flying until the scouts have been overhauled. Power distribution acknowledged."

"Power checking." The voice from the speaking tube was a little deeper than Dondragmer's.

"Life support acknowledge."

"Life support checking."

"Communication acknowledge."

"Checking."

"Kervenser to the bridge for standby. I'm going outside. Research, give me outside conditions."

"One moment, Captain." The pause was brief before the voice resumed, "Temperature 77; pressure 26.1; wind from 21, steady at 200 cables per hour; oxygen fraction standard at 0.0122."

"Thanks. Not too bad."

"No. With your permission, I'll come out with you to get surface samples. May we set up the drill? We can get cores to a fair depth in less than ten hours."

"That will be all right. I may be outside before you get to the lock, if you take time to collect the drill gear, but you are cleared outside when ready. Tell Kervenser the number of your party, for the log."

"Thank you, Captain. We'll be there right away."

Dondragmer relaxed at his station; he would not, of course, leave the bridge until his relief appeared, even with the engines stopped. Kervenser would be some minutes in arriving, since he would have to turn his current duties over to a relief of his own. The wait was not bothersome, however, since there was plenty to think about. Dondragmer was not the worrying type—the Mesklinite nervous system does not react to uncertainty in that way—but he did like to think situations out before he lived them.

The fact that he was some ten or twelve thousand miles from help, if the *Kwembly* were ever crippled, was merely background, not a special problem. It did not differ essentially from the situation he had faced for most of his life on Mesklin's vast seas. The principal ripple on his normally placid self-confidence was stirred up by the machine he commanded. It resembled in no way the flexible assemblage of rafts which was his idea of a ship. He had been assured that it would float if occasion arose; it actually had floated during tests on distant Mesklin where it had been built. Since then, however, it had been disassembled, loaded into shuttle craft and lifted into orbit around its world of origin, transferred in space to an interstellar flier, shifted back to another and very different shuttle after the three-parsec jump, and

brought to Dhrawn's surface before being reassembled. Dondragmer had personally supervised the disassembly and reconstruction of the *Kwembly* and her sister machines, but the intervening steps had not been carried out under his own eye. This formed the principal reason for his wanting to go outside now; high as was his opinion of Beetchermarlf and the rest of his picked crew, he liked first-hand knowledge.

He did not, of course, mention this to Kervenser when the latter reached the bridge. It was something which went without saying. Anyway, the first officer presumably felt the same himself.

"Maintenance checks are under way. The researchers are going out to sink a well, and I'm going out to look things over," was all Dondragmer said as he resigned his station. "You can signal me with outside lights if necessary. It's all yours."

Kervenser snapped two of his nippers light-heartedly. "I'll ride it, Don. Enjoy yourself." The captain left by way of the still open hatch which had admitted his relief, telling himself as he went that Kervenser wasn't as casual as he sounded.

Four decks down and sixty feet aft of the bridge was the main air lock. Dondragmer paused several times on the way to talk to members of his crew as they worked among the cords, beams, and pip-

ing of the *Kwembly's* interior. By the time he reached the lock four scientists were already there with their drilling gear, and had already started to don their airsuits. The captain watched critically as they wriggled their long bodies and numerous legs into the transparent envelopes, made the tests for tightness, and checked their hydrogen and argon supplies. Satisfied, he gestured them into the lock and began suiting up himself. By the time he was outside the others were well on with setting up their apparatus.

He glanced at them only briefly as he paused at the top of the ramp leading from lock to ground. He knew what they were doing and could take it for granted, but he could never be that casual about the weather. Even as he latched the outer lock portal behind him he was looking at as much of the sky as the towering hull of his command permitted.

The darkness was deepening very, very slowly as Dhrawn's two-month rotation carried the feeble sun farther below the horizon. As at home, the horizon itself seemed to be somewhat above his level of sight all around. The gravity-squeezed atmosphere responsible for this effect would also set the stars twinkling violently when they became visible. Dondragmer glanced toward the bow, but the twin stars which guarded the south

celestial pole, Fomalhaut and Sol, were still invisible.

A few cirrus clouds showed above, drifting rapidly toward the west. Evidently the winds a thousand or two feet above were opposed to the surface ones, as usual during the daytime. This might change shortly, Dondragmer knew; only a few thousand miles to the west was country in which the setting of the sun would make a greater temperature change than it did here, and there might be weather changes in the next dozen hours. Exactly what sort of changes was more than his Mesklinite sailor's background, even fortified with alien meteorology and physics, enabled him to guess.

For the moment, though, all seemed well. He made his way down the ramp to the snow and a hundred yards to the west—the lock was on the starboard side—partly to make sure of the rest of the sky and partly to get an overall view of his command before commencing a detailed inspection.

The eastern sky was no more threatening than the rest, and he favored it with only a brief glance.

The *Kwembly* looked just as usual. To a human being it would probably have suggested a cigar made of dough and allowed to settle on a flat table for a time. It was slightly over a hundred feet in length, between twenty and twenty-five in breadth, and its highest point was nearly twenty feet above

the snow. Actually there were two such points; the upper curve of the hull, about a third of the way back, and the bridge itself. The latter was a twenty-foot crosspiece whose nearly square outlines somewhat spoiled the smooth curves of the main body. It was almost at the bow, permitting helmsman, commander, and conning personnel to watch the ground as they traveled almost to the point where the forward trucks covered it.

The flat bottom of the vehicle was nearly a yard off the snow, supported on an almost continuous set of tread-bearing trucks. These were individually castered and connected by a bewildering rigging of fine cables, allowing the *Kwembly* to turn in a fairly short radius with reasonably complete control of her traction. The trucks were separated from the hull proper by what amounted to a pneumatic mattress, which distributed traction and adapted to minor ground irregularities.

A caterpillarlike figure was making its way slowly along the near side of the land-cruiser, presumably Beetchermarlf continuing his inspection of the rigging. Twenty yards closer to the captain the short tower of the core drill had been erected. Above, clinging to the holdfasts which studded the hull but could hardly be seen at the captain's distance, other crew members were climbing about as they inspected the seams for tight-

ness. This, to a Mesklinite, was a nerve-stretching job. Acrophobia was a normal and healthy state of mind to a being reared on a world where polar gravity was more than six hundred times that of Earth, and even "home" gravity a third of that. Dhrawn's comparatively feeble pull, scarcely thirteen hundred feet per second squared, took some of the curse off climbing, but hull inspection was still the least popular of duties. Dondragmer crawled back across the hard-packed mixture of white crystals and brown dust, interrupted by occasional sprawling bushes, and made his way up the side to help out with the job.

The great, curved plates were of boron fiber bonded with oxygen and fluorine loaded polymers. They had been fabricated on a world none of the Mesklinites had ever seen, though most of the crew had had dealings with its natives. The human chemical engineers had designed those hull members to withstand every corrosive agent they could foresee. They fully realized that Dhrawn was one of the few places in the universe likely to be even worse in this respect than their own oxygen-and-water world. They were quite aware of its gravity. They had all these factors in mind when they synthesized the hull members and the adhesives which held them together—both the temporary cements used during

the testing on Mesklin and the supposedly permanent ones employed in reassembling the vehicles on Dhrawn. Dondragmer had every confidence in the skill of those men, but he could not forget that they had not faced and never expected to face, personally, the conditions their products were fighting. These particular parachute packers would never be asked to jump, though that specific analogy would never occur to a Mesklinite.

Much as the captain respected theory, he knew very well the gap between it and practice, and he devoted full attention to examining the joints between the great hull sections.

By the time he had satisfied himself that they were still sound and tight, the sky had become noticeably darker. Kervenser, in response to a rap on the outside of the bridge and a few gestures, had turned on some of the outside lights. By their aid the climbers finished their work and made their way back onto the snow.

Beetchermarlf appeared from under the great hull and reported his tiller lines in perfect shape. The workers at the drill had recovered several feet of core, and were taking this into the laboratory as soon as each segment was obtained, in view of the current temperature. Actually the local snow seemed to be nearly all water at the surface, and, therefore, safely below its

melting point, but no one could be sure how true this would be for the deeper layers.

The artificial light made the sky less noticeable, and the first warning of changing weather was a sudden gust of wind. The *Kwembly* rocked slightly on her treads, and the tiller lines sang as the dense air swept past them. The Mesklinites were not inconvenienced, since in Dhrawn's gravity blowing them away would have been a job for a respectable tornado; they weighed about as much as a life-sized gold statue of them would have on Earth. Dondragmer, as he dug his claws reflexively into the dusty snow, was not bothered by the wind; but he was much annoyed at his own failure to notice earlier the clouds which accompanied it. These had changed from the fleecy cirrus perhaps a thousand feet above to broken height. There was no precipitation yet, but none of the sailors doubted that it would come soon. They could not guess, however, what form it would take or how violent it might be. They had been a year and a half on Dhrawn by human measure, but this was not nearly long enough to learn all the moods of a world far larger than their own. Even if that world had completed one of its own revolutions in that time, instead of less than a quarter of one, it would not have been enough, and Dondragmer's crew knew it.

The captain's voice rose above the song of the wind.

"Inside, everyone. Berjendee, Reffel, and Stakendee to me to help with the drilling gear. First man inside tell Kervenser to stand by on engines and be ready to swing bow to wind when the last of us is aboard." Dondragmer knew as he gave the command that it might be impossible to obey it. It was quite likely that the maintenance check might be at a stage which would prevent engine start. Having issued the order, however, he thought about it no further. It would be carried out if possible, and his attention was needed elsewhere. The drilling equipment, like the rest of the research apparatus, was top priority—the entire reason for the Mesklinites' presence on Dhrawn—and had to be saved. He suspected that at least some of the human and other alien sponsors of the project regarded it as worth a good deal more than a Mesklinite life or two; and they, after all, were the customers.

The researchers had already withdrawn the bit when he reached them. At his gesture, one of them started inside with the precious piece of hardware. The crank and gear box followed, leaving only the supporting frame and guide tower. These were not quite so important, since they could be replaced without human assistance, but the wind was not growing any worse and the captain and his helpers stayed

to dismantle them also. By the time they had finished, the others had vanished inside, and Kervenser was obviously impatient on the bridge above.

Thankfully, Dondragmer shepherded his group up the ramp and through the lock door, which he latched behind them. They were now standing on a yard-wide shelf running the length of the lock, and facing an equally wide pool of liquid ammonia which formed the in-board half of the compartment. The most heavily burdened of the group climbed into the liquid, using holds similar to those on the outer hull; others, like the captain, simply dived in. The inner wall of the lock extended four feet below the surface, and had a three-foot clearance between its lower edge and the bottom of the tank. Passing under this and climbing the far side, they emerged on a ledge similar to that at the entrance; and another door gave them ingress to the midsection of the *Kwembly*.

There was a slight stink of oxygen about them, since a few bubbles of outside air usually accompanied anything which went through the lock, but the ammonia vapor and catalyst surfaces exposed at many sites within the hull had long ago shown themselves able to keep this nuisance under control. Most of the Mesklinites had learned not to mind the odor too much, and as far as anyone

knew really small traces of the gas were harmless.

The researchers doffed their suits and made off with their apparatus and the cases which had protected their cores from the liquid ammonia. Dondragmer dismissed the others to their regular duties, and headed for the bridge. Kervenser started to leave the command station as the captain came through the hatch, but the latter waved him back and went to the starboard end of the superstructure. Portions of its floor were transparent (the human designers had originally intended it all to be so, but they had failed to allow for Mesklinite psychology. Crawling about on the hull was bad enough, but standing on a transparent floor over fifteen feet or so of empty air was beyond all reason). The captain stopped at the edge of one of the floor panes and looked down gingerly.

The grayish surface about the huge vehicle was unchanged; the wind which shook the hull was making no apparent impression on snow packed by two-score Earth gravities and no one knew how much time. Even the eddies around the *Kwembly* showed no signs of their presence, though Dondragmer had rather expected them to be digging holes at the edges on his treads. Farther out, to the limit reached by the lights, nothing could be seen on the expanse except the holes where the cores had been dug and the whipping

branches of an occasional bush. He watched these closely for several minutes, expecting the wind to make some impression there if anywhere, but finally shifted his attention to the sky.

A few bright stars were beginning to show between the patches of scud, but the Guardians of the Pole could not be seen. They were only a few degrees above the southern horizon—much of that due to refraction—and the clouds formed a more complete barrier to the slanting view. There was still no sign of rain or snow, and no way of telling which if either to expect. The temperature outside was still just below the melting point of pure ammonia and far below that of water, but mixtures were more than likely. What these would do to the nearly pure water-ice under him was more than Don-dragmer cared to guess; he knew about the mutual solubility of water and ammonia, but had never attempted to memorize phase diagrams or freezing-point tables of the various possible mixtures. If the snow did dissolve, the *Kwemby* might get a chance to show her floating ability. He was not really eager to make the test.

Kervenser interrupted his thoughts.

"Captain, we will be ready to move in four or five minutes. Do you want driving power?"

"Not yet. I was afraid that the

wind would cut the snow out from under us and tip us over, like backwash on a beached ship, and I wanted to be bow-on if that happened; but there seems to be no danger of it so far. Have the maintenance checks continue except for items which would interfere with a five-minute warning for drive power."

"That's what we're doing, Captain. I set it up when your order came in a few minutes ago."

"Good. Then we'll keep outside lights on and watch the ground around us until we're ready to go again, or until the blow ends."

"It's a nuisance not being able to guess when that will be."

"It is. At home a storm seldom lasts more than a day, and never more than hour or so. This world turns so slowly that storm cells can be as big as a continent, and could take hundreds of hours to pass. We'll just have to wait this one out."

"You mean we can't travel until the wind goes down?"

"I'm not sure. Air scouting would be risky, and we couldn't go fast enough without it to be worth the trouble, as far as the human crowd is concerned."

"I don't like going so fast anyway. You can't really look over a place unless you stop for a while. We must be missing a lot that even the human funnies would find interesting."

"They seem to know what they

want—something about being able to decide whether Dhrawn is a planet or a star—and they are paying the bills. I agree it must be boring for people with nothing but routine to hold their attention.”

Kervenser let the implications of that remark pass unmentioned, if not unnoticed. Whatever he might have said was interrupted by the return of the helmsman.

“Sir, the tiller lines are all in good shape,” the newcomer reported. “I had finished outside before the wind came, as I reported, and all that remained to cover aboard was the spare system aft. Nothing shows any sign of wear, either on the lines themselves, the pulleys, or the guides.”

“Good. You’re relieved, but tell Takoorch . . . he follows you on, doesn’t he? . . . stand by. We may need to move.”

“Yes, sir.” Beetchermarlf disappeared, and for the next few minutes the bridge was silent except for an occasional hoot from a speaking tube as another section reported its status, and Kervenser’s brief acknowledgments. Then the new helmsman arrived, and conversation picked up.

None of it was particularly important, however. Takoorch had a tendency to relate all remarks made in his hearing to his own experiences, which always seemed to have been more noteworthy than anyone else’s. Kervenser had never given up trying to find the limits

of the fellow’s imagination and gall, but Dondragmer found himself able to ignore all but occasional snatches of the conversation. He was more interested in what was going on outside, little as that seemed to be at the moment.

He cut off the bridge lights and all the outside ones but the lowest floods, giving himself a better view of the sky without completely losing touch with the surface. The clouds were fewer and smaller, but they seemed to be moving past fully as rapidly as before. The sound of the wind remained about the same. More stars were slowly appearing; once he glimpsed one of the Guardians, as the Mesklinite sailors had so quickly named them, low to the south. He could not tell which it was; Sol and Fomalhaut were about equally bright from Dhrawn, and their violent twinkling through the huge world’s atmosphere made color judgment unreliable. The glimpse was brief anyway, since the clouds were not completely gone.

“. . . The whole starboard group of rafts peeled off, with everyone but me on the main body . . .”

Still no rain or snow, and the clearing skies made them seem less likely now, to the captain’s relief. A check with the laboratory through one of the speaking tubes informed him that the temperature was dropping; it was now seventy-

five, three degrees below the ammonia melting point. Still close enough for trouble with mixtures, but heading in the right direction.

"... Of the islands south and west of Dingbar. We'd been ridden ashore by a storm bulge, and were high and dry with half the drift boards broken. I . . ."

The stars overhead were almost uninterrupted now; the scud had nearly vanished. The constellations were familiar, of course—most of the brighter stars in this neighborhood are little affected by a three-parsec change in viewpoint. Dondragmer had had plenty of time to get used to the minor changes, anyway, and no longer noticed them. He tried to find the Guardians once more, but still had no luck. Maybe there were still clouds to the south. It was too dark now to be sure. Even cutting the rest of the floods for a moment didn't help. It did, however, attract the attention of the other two, and the flow of anecdote ceased for a moment.

"Anything changing, Captain?" Kervenser's jocular attitude vanished at the possibility of action.

"Possibly. Stars are showing above, but not to the south—not anywhere near the horizon, in fact. Try a spot."

The first officer obeyed, and a spear of light flicked upward from a point behind the bridge as he touched one of the few electrical controls. Dondragmer manipulated

a pair of pull cables, and the beam swung toward the western horizon. A wail which was the rough equivalent of a human grunt of surprise came from Kervenser as the descending beam became more visible parallel to the ground.

"Fog!" exclaimed the helmsman. "Thin, but that's what's blocking the horizon." Dondragmer gave a gesture of agreement as he reared to a speaking tube.

"Research!" he hooted. "Possible precipitation. Check what it is, and what it could do to this water-ice under us."

"It will take a while to get a sample, sir," came the answer. "We'll be as quick as we can. Are we cleared outside, or will we have to work through the hull?"

The captain paused for a moment, listening to the wind and remembering how it had felt.

"You're cleared out. Be as quick as you can."

"On the way, Captain."

At Dondragmer's gesture, the first officer cut off the spot, and the three went to the starboard end of the bridge to watch the outside party.

Quick as these were, the haze was becoming more noticeable by the time the lock opened. Two caterpillarlike forms emerged carrying a cylindrical package between them. They made their way forward to a point almost under the watchers, and set up their equip-



ment—essentially a funnel facing into the wind and feeding into a filter. It took several minutes to convince them that they had a big enough sample, but eventually they dismantled the equipment, sealed the filter into a container to preserve it from the lock fluid, and made their way back to the entrance.

"I suppose it will take them a day to decide what it is, now," grumbled Kervenser.

"I doubt it," replied the captain. "They've been playing with quick tests for water-ammonia solutions. I think Borndender said something about density being enough, with a decent size sample."

"In that case, why are they taking so long?"

"They could hardly be out of their airsuits yet," the captain pointed out patiently.

"Why should they get out of them before delivering to the lab? Why couldn't—"

A hoot from a speaking tube interrupted him. Dondragmer acknowledged.

"Just about pure ammonia, sir. I

think it was supercooled liquid drops; it froze into a sort of froth in the filter, and let quite a bit of outside air loose when we melted in here. If you should smell oxygen for the next few minutes, that's it. It may start icing up the hull, and, if it coats the bridge as it did the filter, it will interfere with your seeing, but that's all I can guess at right now in the way of trouble."

It was not all Dondragmer could see, but he acknowledged the information without further comment.

"This sort of thing hasn't happened since we've been here," he remarked. "I wonder whether it's some sort of seasonal change coming on us. We are getting closer to this sun. I wish the human crowd had watched this world for a longer time before they sold us on the idea of exploring it for them. It would be so nice to know what comes next.

"Kervenser, start engines. When ready, turn bow into wind and proceed ahead dead slow, if you can still see out. If not, circle as sharply as possible to port, to stay on surface we know. Keep an eye



on the treads—figuratively, of course; we can't see them without going out—and let me know if there's evidence that anything is sticking to them. Post a man at the stern port; our trail might show something. Understand?"

"The orders—yes, sir. What you're expecting—no."

"I may be wrong, and if I'm right there's probably nothing to do anyway, I don't like the idea of going outside to clear the treads manually. Just hope."

"Yes, sir." Kervenser turned to his task, and as the fusion engines in the *Kwembly's* trucks came to life, the captain turned to a block of plastic about four inches high and wide and a foot long, which lay beside his station. He inserted one of his nippers in a small hole in the side of the block, manipulated a control, and began to talk.

II

His voice traveled fast, but it was a long time on the way. The radio waves carrying it sped through Dhrawn's heavy but

quickly thinning atmosphere and through the space beyond for second after second. They weakened as they traveled, but half a minute after they were radiated their energy was still concentrated enough to affect a ten-foot dish antenna. The one they encountered was projecting from a cylinder, some three hundred feet in diameter and half as long, which formed one end of a structure closely resembling a barbell, spinning slowly about an axis perpendicular to its bar and midway between its weights.

The current induced by the waves in the antenna flicked, in a much shorter time, into a pinhead-sized bit of tailored crystal which rectified it, enveloped it, used the envelope to modulate an electron stream provided by a finger-sized generator beside it, and thus manipulated an amazingly old-fashioned dynamic cone in a thirty-foot-square room near the center of the cylinder. Just thirty-two seconds after Dondragmer uttered his words they were reproduced for the ears of three of the fifteen hu-

man beings seated in the room. He did not know who would be there at the time, and, therefore, spoke the human tongue he had learned rather than his own language; so all three understood him.

"This is an interim report from the *Kwembly*. We stopped two and a half hours ago for routine maintenance and investigation. Wind was about two hundred cables at the time, from the west, sky partly cloudy. Shortly after we got to work the wind picked up to over three thousand cables—"

One of the human listeners was wearing a puzzled expression, and after a moment managed to catch the eye of another.

"A Mesklinite cable is about two hundred six feet, Boyd," the latter said softly. "The wind jumped from about five miles an hour to over sixty."

"Thanks, Easy." Their attention returned to the speaker.

"Fog has now closed us in completely, and is getting ever thicker. I don't dare move as I had planned; just in circles to keep the treads from icing. The fog is supercooled ammonia according to my scientists, and the local surface is water snow. It doesn't seem to have occurred to my research people, but with the temperature in the seventies it seems to me there's a chance of the fog's dissolving some of the water ice to make a liquid. I realize this machine is supposed to float, and I don't sup-

pose the surface would melt very deeply anyway, but I'm wondering whether anyone has thought much about what will happen if a liquid freezes around our treads. I have to admit I never did, and the thought of chipping the ship loose by muscle power isn't inviting. I know there's no special equipment on board to handle such a situation, because I assembled and loaded this machine myself. I'm simply calling to report that we might possibly be here a good deal longer than planned. I'll keep you informed, and if we do get immobilized we'll be glad of projects to keep our scientists busy. They've already done most of the things you set up for an ordinary stop."

"Thanks, Don," replied Easy. "We'll stand by. I'll ask our observers and aerologists whether they can make a guess about the size of your fog bank, and how long it's likely to stay around you. They may have some useful material already, since you've only been on the night side for a day or so. For that matter, they may even have current pictures; I don't know all the limits of their instruments. Anyway, I'll check and let you know."

The woman opened her microphone switch and turned to the others as her words sped toward Dhrawn.

"I wish I could tell from Don's

voice whether he's really worried or not," she remarked. "Every time those people run into something new on that horrible world, I wonder how we ever had the gall to send them there—or how they had the courage to go."

"They certainly weren't forced, or tricked, into it, Easy," pointed out one of her companions. "A Mesklinite who has spent most of his life as a sailor, and covered his home planet from equator to south pole, certainly isn't naïve about any of the aspects of exploring or pioneering. We couldn't have kidded them if we'd wanted to."

"I know that in my head, Boyd, but my stomach doesn't always believe it. When the *Kwembly* was bogged in sand only five hundred miles from the settlement, I was grinding enamel off my teeth until they worked her loose. When Den-sigeref's *Smoj* was trapped in a cleft by a mud flow that formed under it and let it down, I was almost the only one who backed up Barlennan's decision to send another of the big land-rovers to the rescue. When the *Eske*'s crew disappeared with a couple of very good friends of mine, I fought both Alan and Barlennan on the decision *not* to send a rescue crew—and I still think they were wrong. I know there's a job to be done, and that the Mesklinites agreed to do it with a clear understanding of its risks, but when one of those crews gets into trouble I

just can't help imagining myself down there with them, and I tend to take their side when there's an argument about rescue action. I suppose I'll be fired from this place eventually because of that, but it's the way I'm made."

Boyd Mersereau chuckled.

"Don't worry, Easy. You have that job just because you do react that way. Please remember that if we do disagree strongly with Barlennan or any of his people, we're six million miles and forty G's of potential away, and he's probably going to do what he wants anyway. Whenever it gets to that point, it's very much to our advantage to have someone up here whom he can regard as being on his side. Don't change a bit, please."

"Hm-m-m." If Elise Hoffman was either pleased or relieved, she failed to show it. "That's what Ib is always saying, but I've been writing him off as prejudiced."

"I'm sure he is, but that doesn't necessarily disqualify him from forming a sound opinion. You must believe some things he says."

"Thanks, Easy," Dondragmer's answer interrupted the discussion. He was using his own language this time, which neither of the men understood very well. "I'll be glad of any word your observers can supply. You needn't report to Barlennan unless you particularly want to; we aren't actually in trouble yet, and he has enough on

his mind without being bothered by maybe's. The research suggestions you can send down straight to the lab on Set 2: I'd probably mix them up if I relayed. I'll sign off now, but we'll keep all four sets manned."

The speaker fell silent, and Aucoin, the third human listener, got to his feet, looking at Easy for a translation. She obliged.

"That means work," he said. "We had a number of longer programs planned for later in the *Kwembly's* trip, but, if Dondragmer may be delayed long where he is, I'd better see which of them would fit now. I got enough of that other speech to suggest that he doesn't really expect to move soon. I'll go to Computation first and have them reduce a really precise set of position bearing for him from the shadow satellites, next to Atmospherics for their opinion, and then I'll be in the planning lab."

"I may see you in Atmospherics," replied Easy. "I'm going now to get the information Dondragmer wanted, if you'll stand watch here, Boyd."

"All right, for a while. I have some other work to do myself, but I'll make sure the *Kwembly's* screens are covered. You'd better tell Don who's here, though, so he won't send up an emergency message in Stennish or whatever he calls his native language. Come to think of it, though, I suppose sixty

seconds extra delay wouldn't matter much, considering what little we could do for him from here."

The woman shrugged, spoke a few words of the little sailor's language into the transmitter, waved to Mersereau, and was gone before Dondragmer received her last phrase. Alan Aucoin had already left.

The meteorology lab was on the "highest" level of the cylinder, enough closer to the spin axis of the station to make a person about ten percent lighter than in the communication room. Facilities for exercise being as limited as they were, powered elevators had been omitted from the station's design, and intercoms were regarded as strictly emergency equipment. Easy Hoffman had the choice of a spiral stairway at the axis of symmetry of the cylinder or any of several ladders. Since she wasn't carrying anything, she didn't bother with the stairs. Her destination was almost directly "above" Communications, and she reached it in less than a minute.

The most prominent features in this room were two twenty-foot-diameter hemispherical maps of Dhrawn. Each was a live vision screen carrying displays of temperature, reference-altitude pressure, wind velocity where it was obtainable, and such other data as could be obtained either from the low-orbiting shadow satellites or

the Mesklinite exploring crews. A spot of green light marked the Settlement just north of the equator, and nine fainter yellow sparks scattered closely around it indicated the exploring land-cruisers. Against the background of the gigantic planet their spread made an embarrassingly small display, scattered over a range of some eight thousand miles east and west and twenty or twenty-five thousand north and south, on the western side of what the meteorologists called Low Alpha. Except for two which were well out in the colder regions to the west, all the yellow lights were in a rough arc framing the edge of the Low. The general plan, Easy knew, included ringing that warm area completely with seismic repeaters and other sensing equipment at sites not more than five hundred miles apart; but little more than a quarter of its eighty thousand mile perimeter had so far been covered.

The cost had already been high—not merely in money, which Easy tended to regard simply as a measure of effort expended, but in life. A tenth yellow light, somewhat inside the Low itself, was ringed with red. Seven months—some three and a half of Dhrawn's days—had passed since there had been any sign of the *Esket's* crew, though her transmitters were still sending up pictures of deserted sections of her interior. Easy's expression tightened briefly as she

thought of Destigmat and Kabremm, who had been as good friends as anyone can become without ever meeting personally . . .

"H'lo, Easy," and "Hi, Mom," cut into this gloomy train of thought.

"Hello, weathermen," she responded. "I have a friend who'd like a forecast. Can you help?"

"If it's for here in the station, yes," answered Benj Hoffman.

"Don't be cynical, son. You're old enough to understand the difference between knowing nothing and not knowing everything." Neither took the other seriously, though the woman wasn't quite sure she had used just the right tone. "It's Dondragmer of the *Kwemby*." She pointed to the southernmost of the yellow lights on the map, and quickly outlined the situation. "Alan will be here in a few minutes with a more exact position, if that will help," she finished.

"Probably not much," Seumas McDevitt admitted. "If you don't like cynicism, I'll have to pick my words carefully; but the light on the screen there should be right within a few hundred miles, and I doubt that we can compute a precise enough forecast for that to make a significant difference."

"I wasn't sure you'd have enough material for any predictions at all," Easy countered. "I understand that weather comes

from the west even on this world, and the area to the west has been out of sunlight for days now. Can you see such places well enough to get useful data?"

"Oh, sure." Benj's sarcasm had vanished and the enthusiasm which had caused him to put down atmospheric physics as his post-primary tentative was taking over. "We don't get much of our measurement from reflected sunlight anyway; nearly all is direct radiation from the planet. There's a lot more emitted than it receives from the sun anyway; you've heard the old argument as to whether Dhrawn ought to be called a star or a planet. We can tell ground temperature, a good deal about ground cover, lapse rates, and clouds. Winds are harder—" he hesitated, seeing McDevitt's eye on him and unable to read the meteorologist's poker face. The man read the trouble in time and nodded him on before the rush of self-confidence had lost momentum. McDevitt had never been a teacher, but he had the touch.

"Winds are harder because of the little uncertainty in cloud heights and the fact that adiabatic temperature changes often have more to say about the location of clouds than air mass identities do. In that gravity, the air density drops by half about every hundred yards of climb, and that makes for terrific PV changes in temperature—" he paused again, this time

eyeing his mother. "Do you know about that sort of thing, or should I slow down?"

"I'd hate to have to solve quantitative problems on what you've just been saying," Easy replied, "but I think I have a fair qualitative picture. I get the impression that you're a little doubtful about telling Don to the nearest minute when his fog is going to clear. Would a report from him on surface pressures and winds be any help? The *Kwembly* has instruments, you know."

"It might," McDevitt admitted as Benj nodded silently. "Can I talk to the *Kwembly* directly? And will any of them understand me? My Stennish doesn't exist yet."

"I'll translate if I can keep your technical terms straight," replied Easy. "If you plan to do more than a one-month tour here, though, it would be a good idea to try to pick up the language of our little friends. Many of them know some of ours, but they appreciate it."

"I know. I plan to. I'd be glad if you'd help me."

"When I can, certainly; but you'll see a lot more of Benj."

"Benj? He came here three weeks ago with me, and hasn't had any better chance to learn languages than I have. We've both been checking out on the local observation and computer nets, and filling in on the project back-

ground." Easy grinned at her son.

"That's as may be. He's a language bug like his mother, and I think you'll find him useful, though I admit he got his Stennish from me rather than the Mesklinites. He insisted on my teaching him something that his sisters wouldn't be able to listen in on. Write as much of that off to parental pride as you like, but give him a try. Later, that is; I'd like that information for Dondragmer as soon as we can get it. He said the wind was from the west at about sixty miles an hour, if that helps at all."

The meteorologist pondered a moment.

"I'll run what we have through integration, with that bit added," he said finally. "Then we can give him something when we call, and if the numerical details he gives us then are too different we can make another run easily enough. Wait a moment."

He and the boy turned to their equipment, and for several minutes their activities meant little to the woman. She knew, of course, that they were feeding numerical data and weighing values into computing devices which were presumably already programmed to handle the data appropriately. She was pleased to see Benj apparently handling his share of the work without supervision; she and her husband had been given to understand that the boy's mathematical powers might

not prove up to the need of his field of interest. Of course, what he was doing now was routine which could be handled by anyone with a little training whether he really understood it or not, but Easy chose to interpret the display as encouraging.

"Of course," McDevitt remarked as the machine was digesting its input, "there'll be room for doubt anyway. This sun doesn't do very much to the surface temperature of Dhrawn, but its effect is not completely negligible. The planet has been getting closer to the sun almost ever since we really got going here three years ago. We didn't have any surface reports except from half a dozen robots until the Meskline settlement was set up a year and a half later, and even their measurements still cover only a tiny fraction of the planet. Our prediction work is almost entirely empirical, no matter how much we want to believe in the laws of physics, and we really don't have enough data for empirical rules yet."

Easy nodded. "I realize that, and so does Dondragmer," she said. "Still, you have more information than he does, and I guess anything is welcome to him at this point. I know if I were down there thousands of miles from any sort of help, in a machine which is really in the test stage, and not even able to see what was around me—well, I can tell you from experience that

it helps to be in touch with the outside. Not just in the way of conversation, though that helps, but so they could more or less see me and know what I was going through."

"We'd have an awful time seeing him," put in Benj. "Even when the air at the other end is clear, six million miles is a long way for telescope work."

"You're right, of course, but I think you know what I mean," his mother said quietly. Benj shrugged and said no more; in fact, a rather tense silence ensued for perhaps half a minute.

It was interrupted by the computer, which ejected a sheet of cryptic symbols in front of McDevitt. The other two leaned over his shoulders to see it, though this did Easy little good. The boy spent about five seconds glancing over the lines of information, and emitted a sound halfway between a snort of contempt and a laugh. The meteorologist glanced up.

"Go ahead, Benj. You can be as sarcastic as you like on this one. I'd advise against letting Dondragmer have these results uncensored."

"Why? What's wrong with them?" asked the woman.

"Well—most of the data, of course, was from shadow satellite readings. I did plug in your wind report, with a bit of uncertainty. I don't know what sort of instruments the caterpillars have

down there, or how precisely the figures were transmitted to you; and you did say *about* sixty for the wind speed. I didn't mention the fog, since you didn't tell me any more than the fact that it was there, and I had no numbers. The first line of this computer run says that visibility in normal light—normal to human eyes, that is, and about the same to Mesklinite ones, I gather—is twenty-two miles for a one-degree blur."

Easy raised her eyebrows. "Just how do you account for something like that? I thought all the old jokes about weathermen had gone pretty well out of date?"

"Actually, they just got stale. I account for it by the simple fact that we don't and can't have complete information for the machine. The most obvious lack is a detailed topographic chart of the planet, especially the couple of million square miles west of the *Kwembly*. A wind coming up or down a slope of six inches per mile at any respectable speed would change its air mass temperature rapidly just from PV change, as Benj pointed out a few minutes ago. Actually, the best maps we have of the topography were worked out from just that effect, but they're pretty sketchy. I'll have to get more detailed measurements from Dondragmer's people and give them another run. Did you say Aucoin was getting a more exact position for the *Kwembly*."

Easy had no time to answer; Aucoin himself appeared in the room. He did not bother with greetings, and took for granted that the meteorologists would have the background information from Easy.

"Eight point four five five degrees south of the equator, seven point nine two three east of the Settlement meridian. That's as close as they'll swear to. Is a thousand yards or so too much uncertainty for what you need?"

"Everybody's being sarcastic today," muttered McDevitt. "Thanks, that'll be fine. Easy, can we go down to Comm and have that talk with Dondragmer?"

"All right. Do you mind if Benj comes along, or is there work he should be doing here? I'd like him to meet Dondragmer, too."

"And incidentally display his linguistic powers. All right, he may come. You, too, Alan?"

"No. There's other work to do. I'd like to know the details on any forecast you consider trustworthy, though, and anything Dondragmer reports which might conceivably affect Planning. I'll be in PL."

The weatherman nodded. Aucoin took himself off in one direction, and the other three made their way down ladders to the communication room. Mersereau had disappeared, as he had intimated he might, but one of the other watchers had shifted his

position to keep an eye on the *Kwembly's* screens. He waved and returned to his place as Easy entered. The others paid the party little attention. They had been aware of Easy's and Mersereau's departures simply because of the standing rule that there were never to be fewer than ten observers in the room at once. The stations were not assigned on a rigid schedule; this had been found to lead to the equivalent of road hypnosis.

The four communication sets tied to the *Kwembly* had their speakers centered in front of a group of six seats. The corresponding vision screens were set higher, so that they could also be seen from the general seats farther back. Each of the six "station" seats was equipped with a microphone and a selector switch permitting contact with any one or all four of the *Kwembly's* radios.

Easy settled herself in a comfortably central chair and switched its microphone to the set on Dondragmer's bridge. There was little to be seen on the corresponding screen, since the transmitter's eye was pointed forward toward the bridge windows and the Mesklinites' report of fog was perfectly correct. Part of the helmsman's station and its occupant could be seen in the lower left-hand corner of the screen; the rest was gray blankness marked off into rectangles by the window braces. The bridge lights were apparently sub-

dued, but the fog beyond the windows was illuminated by the *Kwemby's* outside floods, Easy judged.

"Don!" she called. "Easy here. Are you on the bridge?" She snapped on a timer and shifted her selected switch to the set in the laboratory. "Borndender, or whoever is there," she called, still in Sten-nish, "we can't get a reliable weather prediction with the information we have. We're talking to the bridge, but we'd be glad if you could give us as exactly as possible your present temperature, wind velocity, outside pressure, anything quantitative you have on the fog, and—" she hesitated.

"And the same information for the past few hours, with times given as closely as possible," Benj cut in in the same language.

"We'll be ready to receive as soon as the bridge finishes talking," continued the woman.

"We could also use whatever you have on air, fog, and snow composition," added her son.

"If there is any other material you think might be of help, it will also be welcome," finished Easy. "You're there and we aren't, and there must be some ideas about Dhrawn's weather you've formed on your own." The timer sounded a bell note. "The bridge is coming in now. We'll be waiting for your words when the captain finishes."

The speaker's first words overlapped her closing phrase. The

timer had been set for the light-speed lag of a round-trip message between Dhrawn and the station, and the bridge had answered promptly.

"Kervenser here, Mrs. Hoffman. The captain is below in the life-support room. I'll call him here if you like, or you can switch to the set down there, but, if you have any advice for us, we'd like it as quickly as possible. We can't see a body-length from the bridge, and don't dare move except in circles. The fliers gave us an idea of the neighborhood before we stopped, and it seems solid enough, but we certainly can't take a chance on going forward. We're going dead slow, in a circle about twenty-five cables in diameter. Except when we're bow or stern to the wind, the ship feels as though it were going to capsize every few seconds. The fog has been freezing as it hits the windows, which is why we can't see out. The tracks still seem to be clear, I suppose because they're moving and ice gets cracked off before it can hurt, but I expect the tiller lines to freeze up any time, and getting the ice off them will be a glorious job. I suppose it will be possible to work outside, but I'd hate to do it myself until the wind stops. Having an airsuit ice up sounds unpleasant. Any thoughts?"

Easy waited patiently for Kervenser to finish. The sixty-four second message delay had had a gen-

eral effect on everyone who did much talking between station and planet; they developed a strong tendency to say as much as possible at one time, guessing at what the other party wanted to hear. When she knew that Kervenser had finished and was waiting for an answer, she quickly summarized the message which had been given the scientists. As with them, she omitted all mention of the computer result which had insisted that the weather must be clear. The Mesklinites knew that human science was not infallible—most of them had, in fact, a much more realistic and healthy idea of its limitations than many human beings—but there was no point in making one's self look too silly if it could be helped. She was not, of course, a meteorologist, but she was human and Kervenser would probably lump her in with the others.

The group waited almost silently for the first officer's answer when she finished. Benj's muttered translation for the benefit of McDevitt took only a few seconds longer than the message itself. When the response finally came, it was merely an acknowledgment and a politely expressed hope that they might come up with some useful information soon; the *Kwembly's* scientists had collected the material which the humans had requested and were sending it up immediately.

Both Easy and her son readied

themselves to listen carefully to the data, and the former started a recorder so that she could check it before giving the meteorologist a firm translation; but when the message came it was in the human language. Evidently Borndender was at the other end. McDevitt, after his first surprise, recovered himself and began taking notes. His young assistant kept his eyes on the pencil point and his ears on the speaker.

The report included everything that had been requested, in terminology which meant little to Easy—it was just as well she hadn't been required to translate. She couldn't help feeling a little surprised. She knew that several hundred Mesklinites had received quite comprehensive scientific and technical educations in the last fifty years, though the fact had not been published too widely; but her mental picture of the race, well as she knew some of its members, was colored by her knowledge of the general cultural level of the planet—about like that of twelfth-century Earth. (The picture, of course, was about as accurate for Mesklin, as a whole, as twelfth-century Europe was for Earth, as a whole.) There was something that felt wrong about an eighteen-inch caterpillar's making her feel like a backward student in a science class. He should have been swinging a cutlass like Long John Silver, or at the most prophesying like Merlin.

The other two, however, didn't seem bothered. When the final "over" came through, McDevitt and his assistant uttered a hasty "Thank You" into the nearest microphone and hurried off toward the laboratory. Easy, noting that the selector switch had been set for the bridge radio, corrected it and returned a more careful acknowledgment before signing off. Then, deciding that she would be useless in the meteorology lab, she settled back on the chair which gave her the best view of the *Kwembly's* four screens, and waited for something to happen.

Mersereau returned a few minutes after the others had left, and had to be brought up to date. Otherwise, nothing of note occurred. There was an occasional glimpse of a long, many-legged form on one of the screens, but the Mesklinites were going about their own affairs with no particular regard for the watchers.

Easy thought of starting another conversation with Kervenser; she knew and liked this officer almost as well as she did his captain. However, the thought of the lag between remark and answer discouraged her, as it often did when there was nothing of importance to be said.

Even with no lag, conversation languished. There was little for Easy and Mersereau to say to each other which had not already been

said; a year away from Earth could be counted on to exhaust most subjects of conversation except professional shop talk and matters of private, personal interest. She had little of the latter in common with Mersereau, though she liked him well enough, and their professions overlapped only in connection with talking to Mesklinites.

In consequence there was very little sound in the communication room. Every few minutes one or another of the exploring land-cruisers would send in a report, which would be duly relayed to the Settlement; but most of the human beings on watch had no more occasion for small talk than Easy and Boyd Mersereau. Easy found herself trying to estimate when the weathermen would be back with their forecast—and how reliable the new one would be. Say, two minutes to the lab, or one if they hurried; one more to feed the new material into the computer; two for the run; five minutes of arguing, since she knew her son, over whether this prediction was really any better than the last; a repeat run with modified weights on the variables; two minutes back down to the comm room, since they certainly wouldn't hurry this time—they'd still be arguing. They should be here soon.

But before they made it, things changed. Quite suddenly, the bridge screen demanded attention.

It had been quiet, with gray windows masked by frozen ammonia dominating the foreshortened image of part of the helmsman. The latter had been almost motionless, his tiller bar well over to one side as the *Kwembly* pursued the circular path described by Kervenser.

Then the windows were suddenly clear, though little could be seen beyond them; the communicator's angle of view was not depressed enough to reach ground within range of the lights. Two more Mesklinites appeared and flowed over to the windows, looking out and gesturing with obvious excitement. Mersereau pointed to another screen; there was excitement in the lab, too. So far, none of the little explorers had seen fit to report what was going on; Easy judged they were too occupied with immediate problems, and it was customary for them to keep their sound volume down, or off completely, unless they specifically wanted to speak to the human beings.

At this point the weathermen returned. Easy saw her son out of the corner of her eye, and asked without looking around, "Do you have anything useful this time?"

McDevitt answered briefly, "Yes. Shall I have Benj translate it to them?"

"No. They're in some sort of trouble, it seems. Give them the word yourself. Dondragmer would certainly be on the bridge, or will

be by the time your words get there, when anything like this is going on. Here, use this seat and mike."

The meteorologist obeyed without question—it was the last time for many months that he paid Easy that compliment—and began talking as he settled into the seat.

"Dondragmer, you should have about nineteen hours of reduced visibility. The freezing fog should last for less than another hour; the temperature is going down, and the fog will change to ammonia crystals which shouldn't stick to your windows. If you can get rid of the ice already there, you should at least see through them into the snow. The wind will decrease gradually for about five more hours. By that time, the temperature should be low enough so you needn't worry about eutectic melting. There will be higher clouds for another forty-five hours—" He went on, but Easy had stopped listening.

Near the end of McDevitt's second sentence, long before the beginning of his message could have reached Dhrawn, a Mesklinite had approached the bridge pickup so closely that his grotesque face nearly filled the screen. One of his nipper-equipped arms reached out of sight to one side, and Easy knew he was activating the voice transmitter. She was not surprised to hear the captain's words, in a much calmer tone than she could

have managed under the circumstances.

"Easy or whoever is on watch, please get a special report to Barlennan. The temperature has gone up six degrees, to one hundred three, in the last few minutes, the ice has melted from the windows, and we are afloat."

III

Perhaps it was unkind for Dondragmer to have given his report in the human language. The time taken for translation might have eased the shock a trifle for McDevitt. The worst part, as the meteorologist said later, was realizing that his own prediction was on its way to Dhrawn and nothing could stop it. For a moment he had a wild notion of getting a ship and racing the radio waves to the planet so as to shadow them from the *Kwembly's* receivers. The thought was only a flicker; just so much can be done in thirty-two seconds, and anyway none of the tenders then at the station was capable of faster-than-light flight. Most of them were used in servicing the shadow satellites.

Easy, in the next seat, didn't seem to have noticed the discrepancy between the prediction and Dondragmer's report; at least, she hadn't glanced at him with the expression which nine out of ten of his friends would have used. *Well, she wouldn't*, he thought.

That's precisely why she's on this job.

The woman was manipulating her selector switch again, with her attention focused on a smaller screen above the *Kwembly's* four. At first an indicator beside it was glowing red, but as she worked her switches it turned green, and the image of an office-like room with fully a dozen Mesklinites in view appeared on the screen itself. Easy began her report instantly.

She was brief, of course. All she could give was a repetition of Dondragmer's few sentences. She had finished long before there was any evidence on the screen that her words were being received.

When the response came, however, it was satisfying. Every caterpillar-like body in sight looped around toward the pickup; and while Easy had never learned to read expression on a Mesklinite "face" there was no misunderstanding the wildly waving arms and snapping pincers. One of the creatures raced toward a semi-circular doorway at the far side of the room and disappeared through it. In spite of the creature's red-and-black coloration, Easy found herself reminded of the sight, a few years before, of one of her daughters inhaling a strand of spaghetti. A Mesklinite in a hurry under forty Earth gravities is essentially legless to human eyes.

The sound was not on yet from the Dhrawn end, but there was a

rising buzz of conversation in the human communication room. It was not unusual for the exploring land-cruisers to run into difficulties, but in general the Mesklinites on the screen took them more calmly than the human beings who were helplessly watching. In spite of the lack of intercom in the station, people were entering the room and filling the general seats. Screen after screen in the front monitoring areas was being tuned to the "headquarters" unit in the Settlement. Easy and Mersereau, however, were dividing their attention among the four sets reporting from the *Kwembly*, with only an occasional glance at the other picture.

It was not obvious on the screens that the vehicle was afloat. The transmitters were, of course, sharing any motion it might have, and there was little loose equipment aboard whose motion might have betrayed a pitch or a roll. The bulk of the crew were sailors by training, and lifelong habit prevented them from leaving things around loosely. Easy kept closest watch on the bridge screen hoping to spot something outside which could give a clue to what was occurring, but nothing recognizable could be seen through the windows.

Then the panes were blotted out once more as Dondragmer came back into the foreground and expanded his report.

"There seems to be no immediate danger. The wind is pulling us along fairly rapidly, judging by our wake. Our magnetic course is 66. We are floating level, submerged to about Deck 2. The scientists are trying to compute the density of this liquid, but no one ever bothered to work out displacement tables for this hull as far as I know. If you human beings happen to have that information, my people would be glad to get it. Unless we run into something solid, we seem to be safe; I can't guess at the chances of that. All machinery is functioning properly, except that the treads have nothing to bite on and race if we give them power. That's all for now. If your shadow satellites can keep track of our location, we'll be glad of that information as often as you can manage. Tell Barlennen everything is all right so far."

Easy shifted microphone connections and repeated the captain's report as nearly verbatim as she could. She saw, in due course, that it was being taken down in writing at the other end. She rather hoped that the writer would have some question to ask, not that she was likely to be able to answer it, but she was beginning to get that helpless and useless feeling again. The Mesklinite, however, merely acknowledged the information and headed for the door with his notes. Easy was left to wonder how far he had to go to get them to the

commander; no human being had a very good idea of the layout of the Mesklinite base.

As a matter of fact, the trip was brief. Most of it appeared to be outdoors because of the settlers' attitude toward massive objects overhead—an attitude hard to overcome even on a world where gravity, for them, was only a fraction of its normal value. The "roofs" of the Settlement were almost all of a transparent film brought from their home world, and the only departure from a common, city-wide floor level was dictated by terrain. The thought of either a basement or a second story would never have occurred to a Mesklinite; the many-decked *Kwembly* and her sister vehicles were of basically human and Pan-eshk design.

The messenger wove through a maze of corridors for a distance of some two hundred yards before reaching the commander's office. This was at the northern edge of the cluster of foot-high structures which formed the greater part of the Settlement. It was close to the edge of a six-foot cliff which extended for almost a mile east and west, broken by a dozen or so artificial ramps. On the ground below the cliff, but still with their bridges looming above the transparent coverings of the "city," were two of the huge landcruisers. The wall of Barlennan's room was also transparent and looked

directly out on the nearer of these; the other was parked a thousand feet or so to the east. A few air-suited Mesklinites were also visible outside, dwarfed by the monstrous vehicle they were tending.

Barlennan was watching this group of mechanics critically when the runner entered. The latter used no formality, but burst out with Easy's relayed report as he entered the compartment. By the time the commander had swerved around to take the written version, he had heard it all orally.

It was not satisfactory, of course. Barlennan had had time to think up a number of questions since the first messenger had arrived, and this answered none of them. The commander was impatient, but did not show it too badly.

"I take it there hasn't been anything useful from the human weather experts yet."

"Nothing at all, sir, to us. They may have been talking to the *Kwembly* without our hearing of course."

"True enough. Has word gone to our own weather people?"

"Not as far as I know, sir. There's been nothing very useful to tell them, but Guzmeen may have sent a message there, too."

"All right. I want to talk to them myself anyway. I'll be at their complex for the next half hour or more. Tell Guz."

The messenger made the

affirmative nipper gesture and vanished through the door which had brought him. Barlennan took another, and made his way slowly westward through building after building and the enclosed ramps which connected them and made the Settlement a single unit. Most of the ramps sloped upward, and by the time he turned south away from the cliff he was some five feet higher than his office, though not yet on a level with the bridges of the land-cruisers behind him. The roof fabric bulged a little more tautly above him, since the nearly pure hydrogen in the station did not drop as rapidly in pressure with increasing altitude as did Dhrawn's much denser gas mixture. The Settlement had been built at an elevation which was quite high for Dhrawn, and the total outside pressure was about the same as that at Mesklin's sea level; it was only when the land-cruisers descended to lower elevations that they carried the extra argon to keep their internal pressures balanced.

Since Dhrawn's air carried about two percent oxygen, the Mesklinites were rather careful about leaks. Barlennan still remembered the awkward results of an oxygen-hydrogen explosion shortly after he had first encountered human beings.

The research complex was the westernmost and highest side of the colony, fairly well separated

from most of the other structures and differing from them in having a solid—though still transparent—roof. It also came closer than any other part of the Settlement to having a second story, since a number of instruments were mounted on the roof and could be reached by ramps and liquid-trap air locks. Not all the instruments, either inside or out, had been furnished by the alien sponsors of the Settlement; the Mesklinites had been using their own imaginations and ingenuity in the last fifty years.

Like the exploring vehicles, the laboratory complex was a mixture of sophistication and crudeness. Power came from hydrogen fusion units, but chemical glassware was homemade. Communication with the orbiting station was by solid-state radios, but messengers had to carry the news physically from one room, or building, to another within the Settlement—though steps were being taken, unknown to the human watchers, to change this. The aliens had had, of course, what they considered excellent reasons for limiting the amount and controlling the nature of the technical help they had furnished, and Barlennan had had what he considered equally good reasons for going along with those limitations. Neither party had been completely frank in discussing the matter with the other.

Barlennan's arrival in the central

building of the laboratory group was noticed by only a few of the busy creatures there, but one of these promptly stopped his work and greeted the commander.

"Is someone in trouble, or are you just visiting?" he asked.

"Trouble, I'm afraid. The *Kwembly*, with Dondragmer of all people, is being washed away somewhere. Come to the map room and bring a couple of aerologists along—and find a chemist, too. Don was crossing a snowfield the last I knew, and had been for three million cables or so. Either the temperature went up very suddenly, or the nature of the ice changed, or something brand-new came up."

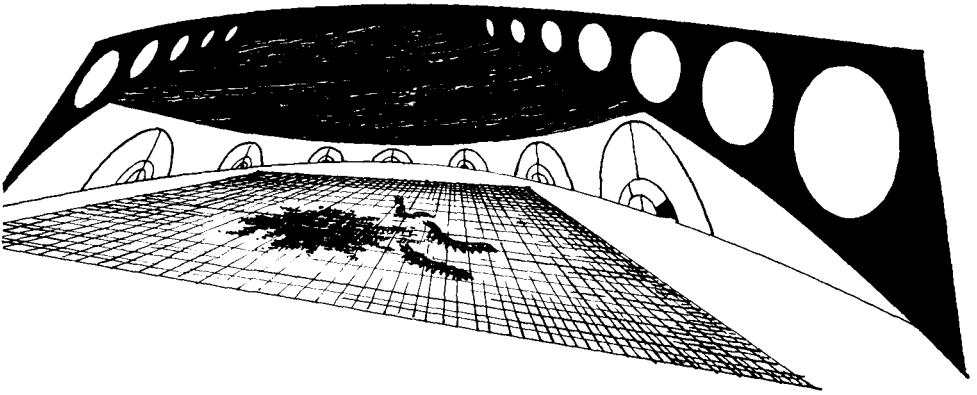
"It could easily be the last," the scientist remarked. "No one has been on this world through one of its years yet. It's coming closer to its sun all the time—it's closer now than it's been since the human put instruments down on it. The sun isn't much, but we can't leave it out of our figuring. There are bound to be some sort of seasonal changes, maybe not like the ones at home, but—"

"But that's just the trouble. If they were like the ones we're used to we'd know what to expect. Well, we knew the chances we were taking; there's no use complaining now. If we told the aliens we wanted to give up and go home, they'd be perfectly justified in giving up on us and leaving us here. I

hate to think what they must have spent on this project so far, and they have a right to expect some return on it. Round up whoever you think may know something useful, and meet me at the big map." Barlennan gestured a hasty dismissal and headed for the largest room in the group.

This was some forty feet square, and almost entirely unfurnished. Its floor was slowly being laid out as a map which would eventually, it was hoped, cover the Low Alpha area which had been selected by the project planners for concentrated study. Like the ones in the station millions of miles above, it bore markers indicating the locations of the exploring land-cruisers; and similarly, it gave anyone who examined it a feeling of futility. Dhrawn—even this small section of it—was *so* big! Over nine times the diameter of Earth, nearly four times that little world's mean density; it has over three times the surface area of even giant Mesklin. The twenty by thirty-five thousand mile oval of Low Alpha covers a larger fraction of its surface than Australia does of Earth's, but not much larger.

On the map, surface features had been indicated in black along the routes followed so far by the land-cruisers. This matched the corresponding information on the human maps above. More data, indicated in red, had been secured



from other sources, and was generally unknown to the beings above. This was one place in the Settlement where there would be no vision transmitter while Barlennan was running things.

At a scale of roughly a thousand miles to the foot, the black markings formed a solid patch a few inches square around the Settlement, with narrow lines extending as much as a dozen feet from it in some directions. If Barlennan had ever seen a photomicrograph of a human nerve cell, he would probably have regarded it as a good simile for what was on the floor around him.

He had reared his forward end up as high as was comfortable, bringing his eyes six or seven inches from the floor, and was looking at the map rather gloomily when the scientists began to arrive. Bendivence was either very optimistic or very much the opposite;

Barlennan couldn't decide which was the more likely reason for his having called nearly twenty people to the conference. These gathered a few feet from the commander, reared up in similar fashion, and waited politely for his information and questions. He started without preamble.

"The *Kwembly* was here at the last report," he indicated. "It had been crossing a field of snow—water snow, nearly pure as regards dissolved material but quite dirty according to Dondragmer's science people."

"Borndender, isn't it?" queried someone. Barlennan made the affirmative gesture and went on.

"The snowfield started about here." He crawled to a spot nearly four feet northwest of the position marker. "It lies between a couple of mountain ranges, which we have indicated only roughly. The air explorers haven't been that far

south yet, except, of course, for Dondragmer's own scouts. A short time ago, while the *Kwembly* was stopped for a routine maintenance check, a heavy wind came up, and then a dense fog of pure or nearly pure ammonia. Then, quite suddenly, the temperature rose several degrees and they found themselves afloat, being blown roughly eastward by the wind. We would like explanations, and we badly need constructive advice. Why did the temperature go up, and why did the snow melt? Is there any connection between the two—remembering that the highest temperature they mentioned was only about a hundred and three, twenty-six or seven degrees below the melting point of water. Why the wind? How long is it likely to last? It's carrying the *Kwembly* toward the hot regions inside Low Alpha south of the *Esket* site." He gestured toward a heavily red-marked section of the floor. "Can we tell how far that way they'll be carried? I didn't want Dondragmer to go out on this trip, and I particularly don't want to lose him even if we don't agree completely.

"We'll call for what help we can get from the men, but you'll have to use your brains, too. I know some of you have been trying to make sense out of Dhrawn's climatology; do you have any ideas you can trust at all, and which might apply here?"

Several minutes of silence fol-

lowed. Even those in the group most given to uttering rhetorical speeches had been working with Barlennan too long to risk them now, and for some time there were no really constructive ideas. Then one of the scientists scuttled toward the door and vanished, with a "Just a moment, I have to check a table" floating behind him. He was back without thirty seconds.

"I can account for the temperature and melting," he said firmly. "The ground surface was water ice, the fog ammonia. The heat of solution as they met and mixed would have caused the temperature to rise. Ammonia-water solutions form eutectics which can melt as low as seventy-one."

Mild hoots of appreciation and approving gestures of nipper-equipped arms greeted this suggestion. Barlennan went with the crowd, though words had been used which were not entirely familiar to him, but he was not through with his questions.

"Does that give us any idea how far the *Kwembly* will be carried?"

"Not by itself. We need information about the extent of the original snowfield," was the answer. "Since only the *Kwembly* has been in the area, about the only hope is the photo maps made by the humans. You know how much we can get from those. Half the time you can't tell between ice and clouds, and they were all made before we landed here."

"Give it a try, anyway," ordered Barlennan. "With luck, you can at least tell whether those mountain ranges to the east are blocking the *Kwembly's* present path. If they are, it's hard to see how they could be carried more than a few hundred thousand cables."

"Right," answered one of the investigators. "We'll check. Ben, Dees, come along; you're more used to the photos than I am." The three vanished through the door. The others broke up into small groups, muttering arguments to each other and waving excitedly, now at the map underfoot, now at less obvious items presumably in the nearby laboratories, Barlennan endured this for several minutes before deciding that a little more guidance was needed.

"If that plateau Don was crossing was such pure water, there couldn't have been any ammonia precipitation there for a long, long time. Why should things change so suddenly?"

"It almost has to be a seasonal effect," answered one of the men. "I can only guess so far, but I'd say it had something to do with some consistent change in the wind pattern. Air currents from different parts of the planet will be saturated with water, or ammonia, according to the nature of the surface they pass over—mostly its temperature, I suppose. The planet is nearly twice as far from its sun at one

time as at another, and its axis is much more inclined than *Mesklin's*. It's easy to believe that at one time of year only water is precipitated on that plateau and at another it gets supplied with ammonia. Actually, water's vapor pressure is so low that it's hard to see what situation would get water into the atmosphere without supplying even more ammonia, but I'm sure it's possible. We'll work on it, but it's another of those times when we'd be a lot better off with world-wide, year-round information. These human beings seem to be in an awful hurry; they could have waited a few more years to land us here, I should think."

Barlennan made the gesture which a human being would have matched with a noncommittal grunt. "The field data *would* be convenient. Just think of yourself as being here to get it instead of having it given to you."

"Of course. Are you going to send the *Kalliff* or the *Hoorsh* out to help *Dondragmer*? This is certainly different from the *Esket* situation."

"From our point of view, yes. It might look funny to the humans, though, if I insisted on sending out a rescue cruiser now after letting them talk me out of it the other time. I'll think it over. There's more than one way of sailing upwind. You do that theoretical work you've just been talking about, but

be thinking about what you'd want to take on a field trip up toward the *Kwembly*."

"Right, Commander." The scientist started to turn away, but Barlennan added a few more words.

"And Jemblakee. No doubt you'll be strolling over to Communications to talk to your human colleagues. Please don't mention this . . . what was it? . . . heat of solution and eutectic business. Let them mention it first, if they're going to, and be properly impressed when and if they do. You understand?"

"Perfectly." The scientist would have shared a grin of understanding with his commander if their faces had been capable of that sort of distortion. Jemblakee left, and after a moment's thought Barlennan did the same.

The remaining researchers and technicians might possibly be the better for his presence to keep their center-boards down, but there were other things to do. If they couldn't hold course without his pincers on their helmets, they'd just have to drift for a while.

He should talk to the human station soon; but if there were to be an argument, as seemed rather likely, he had better do a little course-plotting himself. Some of the two-legged giants such as Aucoin, who seemed to have a great deal to say about their policy, were reluctant to expend or even risk

any sort of reserve equipment, no matter how important the action seemed from the Mesklinite viewpoint. Since the aliens had paid for it, this was perfectly understandable—even laudable; but there was nothing immoral about talking them around to a more convenient attitude if it could be done.

If he could arrange it, the best plan would be to work through that particularly sympathetic female named Hoffman. It was too bad the human beings kept such irregular hours; if they had set up decent, regular watches in their communication section, Barlennan would long since have worked out their schedule and been able to pick his party. He wondered, not for the first time, whether the irregular schedule might not be deliberately set up to block that very technique; but there seemed no way to find out. He could hardly ask.

The Settlement's comm center was far enough from the laboratories to give him thinking time en route. It was also close enough to his office to encourage a pause for making a few notes before actually opening the verbal fencing match.

The central theme would have to be the question of rescue, if Dondragmer's trouble wound up crippling his cruiser. If the corresponding situation involving the *Esket*, months before, was any indication, the tightwads up above

would be basically against sending the *Kalliff*. Of course, there was nothing they could do if Barlennan chose to go his own way in that matter—or in any other, come to think of it—but the commander was hoping to keep that fact cushioned in the decencies of polite conversation. He would be happiest if that aspect of the situation never came up at all; this was one reason he hoped to work Easy Hoffman into the other end of the discussion. For some reason, she seemed prone to take the Mesklinite side when disagreements arose. She was certainly one reason that there had been no open argument during the *Esket* incident—though a more important one was the fact that Barlennan had never had the slightest intention of sending a rescue cruiser that time, and had, therefore, actually been siding with Aucoin.

Well, he could at least go as far as the comm room door and find out who was on duty above. With the rippling equivalent of a shrug, he lifted his sprawled eighteen inches from the office floor and made his way into the corridor. It was at that moment that the wind reached the Settlement.

There was no fog at first, or for some minutes thereafter. Barlennan, promptly changing his plans as the roof began rippling, got all the way back to the laboratories; but before he had a chance to get

any constructive information from his scientists the stars began to fade. Within a few minutes the lights showed a solid gray ceiling a body-length above the Mesklinites. The ceilings here were rigid and did not vibrate in the wind as those in the corridor had, but the sound outside was loud enough to make more than one of the scientists wonder how stable the buildings actually were. They didn't express the thought aloud in the commander's presence, but he could interpret the occasional upward glances when the whine of the heavy outside air increased in pitch.

It occurred to him that his present location was about the most useless possible one for a commander who was not a scientist, since the people around him were about the only ones in the Settlement to whom he could not give reasonable orders. He asked just one question, was informed in reply that the wind speed was about half that which Dondragmer had reported some ten thousand miles away, and headed for the communication room.

He thought briefly of going back to the office on the way, but knew that anyone wanting him would find him almost as quickly at Guzmeen's station. Anyway, a question had crossed his mind which could probably be answered by relay from the human station faster than any other way, and

that question was seeming more and more important as the seconds passed. Forgetting about his intention to make sure that Easy Hoffman was on duty above, he shot into the radio room and nudged politely aside the staff member in front of the transmitter. He began to speak almost before he was in position, and the sight of the Hoffman features when the screen lighted up was merely a pleasant surprise rather than a major relief.

"The wind and fog are here, too," he began abruptly. "Some people were outdoors, and there's nothing I can do about them at the moment; but some were working in the cruisers parked outside. You could check through their communicators whether everything is all right there. I'm not too worried, since the wind speed is much less than Don reported, and, of course, the air is far less dense at this height; but we can't see at all through this fog, and I'd be relieved to know about the men in the cruisers."

Easy's image had started to speak part way through the commander's request—obviously not in answer, since there had not been time enough for the light-speed round trip. Presumably the human beings had something of their own to say. Barlennan concentrated on his own message until it was done, knowing that Guzmeen, or one of his crew, would be writing down

whatever came in. Message crossing, under the general circumstances, was a frequent event and handled by established routine.

With his own words on the way, the commander turned to ask what the humans had wanted, but the question was interrupted. An officer shot into the room and began reporting as soon as he saw Barlennan.

"Sir, all groups, but two, which had checked out the north gates are accounted for. One of these was working in the *Hoorsh*, the other was leveling ground for the new complex twenty cables north, on the other side of the parking valley. There were eight people in the first group, twenty in the second."

Barlennan made the gesture of understanding, all four nippers clicking shut simultaneously. "We may have radio reports from the space station shortly on the *Hoorsh* group," he replied. "How many who were actually outside after the wind and fog arrived have come in? What do they report on living and traveling conditions? Was anyone hurt?"

"No one hurt, sir. The wind was only a minor inconvenience; they came in because they couldn't see to work. Some of them had trouble finding their way, and my guess is that the ground-leveling crew is still groping its way back, unless they just decided to wait it out where they were. The ones on the

Hoorsh may not even have noticed anything, inside. If the first bunch stays out of contact too long, I'll send out a messenger."

"How will you keep *him* from getting lost?"

"Compass, plus picking someone who works outside a lot and knows the ground well."

"I'm not—" Barlennan's objection was interrupted by the radio.

"Barlennan," came Easy's voice, "the communicators in the *Hoorsh* and the *Kalliff* are all working. As far as we can see, there is no one in the *Kalliff* and it's just sitting there; nothing is moving. There are at least three, and possibly five, men in the life-support section of the *Hoorsh*. The man covering those screens has seen as many as three at once in the last few minutes, but isn't too confident of recognizing individual Mesklinites. The cruiser doesn't seem to be affected. The people aboard are going about their business and paying no attention to us. Certainly they weren't trying to send an emergency message up. Jack Bravermann is trying to get their attention on that set now, but I don't think there's anything to worry about. As you say, slower wind and thinner air should mean that your settlement is in no danger if the *Kwembly* wasn't hurt."

"I'm not worried, at least not much. If you'll wait a moment, I'll find out what your last message,

but one, was and try to answer it," returned Barlennan. He turned to the duty officer whose place at the set he had taken. "I assume you got what she said."

"Yes, sir. It wasn't urgent, just interesting. Another interim report has come up from Dondragmer; the *Kwembly* is still afloat, still drifting though he thinks it has dragged bottom once or twice, and the wind is still blowing there. Because of their own motion, his scientists won't commit themselves to an opinion on whether the wind velocity has changed or not."

The commander gestured acceptance, turned back to the communicator, and said, "Thanks, Mrs. Hoffman. I appreciate your sending even 'no change' reports so quickly. I will stay here for a while, so if anything really does happen I will know as soon as possible. Have your atmospheric scientists come up with predictions they trust? Or explanations of what happened?"

To the other Mesklinites in the room it was obvious that Barlennan was doing his best to keep his expression unreadable as he asked this question. His arms and legs were carefully relaxed, chelae neither too tightly closed nor gaping open, his head neither too high nor too close to the floor, his eyes fixed steadily on the screen. The watchers did not know in detail what was in his mind, but could tell that he attached more than its obvious

face value to the question. Some of them wondered why he bothered to control himself so, since it was most unlikely that any human being could interpret his body expression anyway; but those who knew him best realized that he would never take a chance on a matter like that. After all, there were some human beings, of whom Elise Rich Hoffman was emphatically one, who seemed to think very easily from the Mesklinite viewpoint, besides speaking Stennish as well as human vocal equipment would permit.

All watched the screen with interest, wondering whether the human being on it would show signs of having noticed the commander's attitude when her answer came back. All communication room personnel were reasonably familiar with human facial expressions; most of them could recognize at least a dozen different human beings by face or voice alone, the commander having long ago expressed a strong desire that such abilities be cultivated. Barlennan, his glance leaving the screen for a moment and roving around the circle of intent listeners, was amused at their expressions even while he was annoyed at his own obviousness. He wondered how they would react to whatever answer Easy returned, but he never found out.

The human female had evidently received the question and was

starting to form a sentence in reply when her attention was distracted. For several seconds she was obviously listening to something, and her eyes shifted away from the pickup of the Settlement communicator. Then her attention came back to Barlennan.

"Commander. Dondragmer has reported again. The *Kwembly* has stopped, or almost stopped, aground. They are still being dragged a little, however; the flow of liquid has not slowed. They have been tipped so that the trucks are out of contact with whatever surface is below them. If they aren't dragged free by the river, they're there to stay; and Dondragmer thinks the level is going down."

IV

It was a curious, helpless sensation for Beetchermarlf. The *Kwembly's* helm was connected to the trucks by simple pulley-and-cord rigging; even Mesklinite muscles could not turn the trucks when the vehicle was at rest, and while forward motion made steering possible it certainly did not make it easy. Now, floating with the driving units clear of the bottom, the helm flopped limply in response to a casual nudge, or even to a slight roll of the hull. In theory, the cruiser was supposed to be maneuverable at sea, but this involved installing driving paddles on the treads—something most easily

done while still on land. Dondragmer had thought fleetingly, as he realized they were adrift, of sending out airsuited men to attempt the task, but then decided that it wasn't worth the risk even if everyone were attached solidly to the hull by lifelines. It was likely enough, as far as anyone could tell, that they might reach the end or the edge of the river, or lake, or whatever they were floating on before any such job could be completed, anyway; and if men were outside when that happened, lifelines might not be the need.

The same thoughts had crossed the helmsman's mind as he lay at his station, but he did not voice them. Beetchermarlf was young, but not so young as still to assume that no one else could recognize the more obvious facts. He was quite prepared to grant his captain's professional competence.

As the minutes slipped by, however, he began to worry at Dondragmer's failure to issue any orders. Something should be possible; they couldn't just drift eastward—he glanced at the compass; yes, eastward—indefinitely. There had been hills that way according to the last flight reports—the same hills which had bordered the snowfield on their left, sometimes showing slightly above the distant horizon, for the last three or four thousand miles. Judging by their color they were rock, not ice. If the surface the *Kwembly* was float-

ing on were simply melted snowfield, they almost had to hit something soon. Beetchermarlf had no more idea than anyone else how fast they were going, but his confidence in the strength of the hull matched that of the captain. He had no more wish to strike a reef on Dhrawn than he had ever had on Mesklin.

At least, the wind should not move them too fast, dense as the air was. The top of the hull was smoothly curved except for the bridge, and the trucks on the bottom should give plenty of drag. As far as the air scouts had been able to tell the snowfield had been level, so the liquid itself shouldn't be moving. Come to think of it, the outside pressure should give a check on that. The helmsman stirred at the thought, glanced up at the captain, hesitated, and then spoke.

"Sir, how about checking hull-squeeze watch? If there is any current in what we're floating in, we'd have to be going downhill, and that should show—" Dondragmer interrupted.

"But the surface was level—no, you're right. We should check." He reared up to the bank of speaking tubes and called the laboratory. "Born, how is the pressure? You're keeping track, of course."

"Of course, Captain. Both bow and stern safety bladders have been expanding ever since we began to float. We've descended about six

body lengths in twice that many minutes. I'm about ready to tap more argon."

Dondragmer acknowledged, and looked back at his helmsman.

"Good for you. I should have thought of that. That means we are being carried by current as well as wind, and all bets on speed, distance, and where we stop are off. There couldn't be a current unless the air scouts missed a slope, and if there's a slope this plateau must drain somewhere."

"We're secure for rough travel, sir. I don't see what else we can do."

"There's one thing," Dondragmer said grimly. He reared to the tubes again, and emitted the siren-like general quarters call. Reasonably sure that all were listening, he pulled his head back so as to be equally distant from all the tubes, and spoke loudly enough to get through them all.

"All hands into airsuits as quickly as possible. You are relieved from stations for that purpose, but get back as soon as you can." He lowered himself to his command bench and addressed Beetchermarlf. "Get your suit and mine, and bring them back here. Quickly!"

The helmsman was back with the garments in ninety seconds. He started to assist the captain with his, but was dismissed by an emphatic gesture and went to work

on his own. In two minutes both were protected except for head covering, and were back at their stations.

The haste, as it turned out, was unnecessary. More minutes passed while Beetchermarlf toyed with the useless helm, and Dondragmer wondered whether the human scientists were ever going to come through with any information and what use it was likely to be if they did. He hoped that satellite fixes could give him some idea of the *Kwembly's* speed; it would, he thought rather cynically, be nice to know how hard they were likely to hit whatever finally stopped them. Such fixes were, he knew, hard to get on order; there were over thirty of the "shadow-satellites" in orbit, but they were less than three thousand miles above the surface. No attempt had been made to arrange their orbits so that their limited fields of visual and microwave coverage would be either uniform or complete; communication was not their primary purpose. The main human base, in synchronous orbit over six million miles above the Settlement meridian, was supposed to need no help with that task. Also, the ninety-plus mile per second orbital speed of the lower satellites, helpful though the human observers claimed it to be for moving-base-line location checking, still seemed to Dondragmer an inevitable cause of difficulty. He was not at all hopeful about getting his

speed from this source. This was just as well, since he never got it.

Once, about half an hour after going adrift, a brief shudder went through the *Kwembly* and the captain duly reported to the station that they had probably touched bottom. Everyone else on board made the same assumption, and tension began to mount.

There was a little warning just before the end. A hoot from the laboratory speaking tube was followed by a report that pressure had started to rise more rapidly, and that an additional release of argon into the ship's atmosphere had been necessary to keep the safety bladders from rupturing. There was no sensation of increasing speed, but the implication of the report was plain enough. They were descending more rapidly. How fast were they going horizontally? The captain and helmsman looked at each other, not asking the question aloud but reading it in each other's expressions. More minutes passed; the tension slowly mounted, chelae gripping stanchions and holdfasts ever more tightly.

Then there was a thunderous clang, and the hull swerved abruptly; another, and it tilted sharply to starboard. For several seconds it rocked violently, and those near bow and stern could feel it yawing as well, though the fog still prevented any outside view which might have confirmed

the sensation. Then there was another, much louder clang, and the *Kwembly* rolled some sixty degrees once more to starboard; but this time she did not recover. There were scraping, grinding sounds which suggested that she was moving slightly, but no real change of attitude accompanied them. For the first time, the sound of liquid rushing past the hull was noticeable.

Dondragmer and his companion were, of course, unhurt; to beings who regarded two hundred Earth gravities as normal and six hundred as a most minor inconvenience, that sort of acceleration meant nothing. They had not even lost their grips, and were still at their posts. The captain was not worried about direct injuries to his crew; his first words showed that he was considering matters much farther ahead.

"By stations, report!" he belowered into the speaking tubes. "Check hull soundness at all points, and report all cracks, open breaks, dents, and other evidence for leaks. Lab personnel to emergency stations, and check for oxygen. Life-support, cut tank circulation until the oxygen check is done. Now!"

Apparently the speaking tubes were intact, at least. Hoots of response began to return immediately. As the reports accumulated, Beetchermarlf began to relax. He had not really expected

the shell, which protected him from Dhrawn's poisonous air, to withstand anything like such a shock, and his respect for alien engineering went up several grades. He had regarded artificial structures of any sort as normally inferior in strength and durability to any living body. He had, of course, excellent reason for such an attitude. Nevertheless, it appeared when all the reports were finally in that there were no major structural failures or even visible cracks. Whether the normal leaks, unavoidable in a structure which had to have entrances for personnel and equipment, not to mention hull openings for instruments and control lines, were any worse than they had been would not be known for a while; pressure monitoring and oxygen checking would, of course, continue as normal routine.

Power was still on, which surprised no one. The twenty-five independent hydrogen converters, designed as identical modules which could be moved from any energy-using site in the *Kwembly* to any other, were solid-state devices with no moving parts larger than the molecules of gaseous fuel which were fed into them. They could have been placed under the hammer of a power forge without damage.

Most of the outside lights were gone, or at least inoperative, though these could be replaced. Some were still working, however,

and from the submerged end of the bridge it was possible to see out. Fog still blocked the view from the upper end. Dondragmer made his way very gingerly to the low extremity and took a brief look at the conglomeration of rounded rocks, from half his own length to a score of times that diameter, into which his command had managed to wedge itself. Then he climbed back even more circumspectly to his station, energized the sound system of his radio, and transmitted the report which Barlennan was to hear a little over a minute later. He did not wait for an answer, but began issuing orders to the helmsman.

"Beetch, stand by here in case the men have anything to say. I'm going to make a complete check myself, especially of the air locks. With all there is to be said for that design, we didn't have this much of a roll in mind when we settled on it. We may only be able to use the small emergency ones, especially since the main one seems to be underneath us at the moment—it may be blocked on the outside. Chatter with the human beings if you want; the more of us who can use their language, and the more of them who can use ours, the better. You have the bridge."

Dondragmer made the habitual, but now rather futile, gesture of rapping on the hatch for clearance; then he opened it and disappeared, leaving Beetchermarlf alone.

The helmsman had no urge at the moment for idle talk with the station above. His captain had left him with too much to think about.

He was not exactly overwhelmed at being left in charge of the bridge, under the circumstances. He was not even too concerned about the main air lock being blocked; the smaller ones were adequate—though not for life support equipment, he suddenly remembered. Well, at the moment the desirability of going out seemed very small, though if the *Kwembly* were permanently disabled that need would have to be faced.

The real question, in such an event, was just what good going outside would do. The twelve thousand miles or so—which Beetchermarlf thought of as nearly fourteen million cables—was a long, long walk, especially with a load of life-support equipment. Without that apparatus it was not to be thought of; Mesklinites were amazingly tough organisms mechanically, and had a temperature tolerance range which was still disbelieved by many human biologists, but oxygen was another matter. Its partial pressure outside at the moment was presumably about fifty pounds per square inch, quite enough to kill any member of the *Kwembly*'s crew in seconds.

The most desirable line of action at the moment was to get the big machine back on her treads. How, and probably whether, this could

be done would depend largely on the stream of liquid flowing past the stranded hull. Working outside in that current might not be impossible, but it was going to be difficult and dangerous. The air-suited Mesklinites would have to be heavily ballasted to stay put at any task, and lifelines would complicate the details.

The stream might not, of course, be permanent. It had apparently just come into existence with the change in weather, and one might hope that it would cease flowing as suddenly. However, as Beetchermarlf well knew, there is a difference between weather and climate. If the river were seasonal, its to be academic to the Mesklinites; "temporary" nature might turn out Dhrawn's year was some eight times as long as that of Earth, over one and a half times that of Mesklin.

This was the sort of field where human information might be useful. The aliens had been observing Dhrawn carefully for nearly half of one of its years, and casually for much longer. They should have *some* idea of its seasons. The helmsman wondered whether it would be out of order for him to put such a question to someone in the orbiting station, when the captain had not. Of course, the captain *had* said he could use the radio for chatter, and made no mention of what might or might not be said.

The idea that there was anything except the *Esket* incident which should not be discussed with the human sponsors of the Dhrawn expedition had not dripped down the chain of command as far as Beetchermarlf. The young helmsman had almost made up his mind to initiate a call to the station when the radio beside him spoke. It spoke, furthermore, in his own language, though the accent was not above reproach.

"Dondragmer. I know you must be busy, but if you can't talk now I'd be glad if someone else could. I am Benjamin Hoffman, an assistant in the aerology lab here at the station, and I'd like two kinds of help if anyone can find time to give it.

"For myself, I'd like practice in language; it must be obvious that I need it. For the lab, we're in a very embarrassing position. Twice in a row we've worked out weather predictions for your part of the planet which were 'way off. We just don't have enough detailed information to do the job properly. The observations we can make from here don't resolve enough, and there aren't anywhere near enough reporting stations down there. You and the others have planted a lot of automatics on your trips, but they still don't cover much of the planet, as you know. Since good predictions will be as useful to you as they will be

to us, I thought maybe I could talk things out in real detail with some of your scientists, and maybe work out the weather patterns where you are well enough to supplement the background calculations and really get good forecasts, at least right in your neighborhood."

The helmsman replied eagerly.

"The captain is not on the bridge, Benjaminhoffman. I am Beetchermarlf, one of the helmsmen, now on watch. Speaking for myself, I should be very glad to exchange language practice when duties permit, as now. I am afraid the scientists will be pretty busy for a while—I am myself, most of the time. We are having some trouble, though you may not know all the details. The captain did not have time for the full story in the report I heard him send up a few minutes ago. I will give you as complete a picture as I can of the situation, and some thoughts which have occurred to me since the captain left the bridge. You might record the information for your people, and comment on my ideas if you wish. If you don't think they're worth mentioning to the captain, I won't. He'll be busy enough without them anyway. I'll wait until you tell me you're ready to record, or that you don't want to, before I start." Beetchermarlf paused, not entirely for the reason he had just given. He was suddenly afflicted with a doubt whether he should bother one of these alien

beings with his own ideas. They suddenly seemed crude and poorly worked out.

Still, the factual reports could not help being useful; there was obviously much detailed information about the *Kwembly's* present situation which the men could not possibly know yet. By the time Benj's approval came from the speaker, the helmsman had recovered some of his self-confidence.

"That will be fine, Beetchermarlf. I'm ready to tape your report—I was going to anyway, for language practice—and I'll pass on whatever you want. Even if your weathermen are busy, maybe we could try what I suggested with the weather information just between the two of us. After all, you can probably get their measurements, and you're on the spot and can see everything, and if you're one of the sailors Barlennan recruited on Mesklin you certainly know something about weather. For all I know, you may have spent a couple of my lifetimes in that place on Mesklin learning engineering and research methods. Come ahead; I'm ready here."

This speech finished restoring Beetchermarlf's morale. It had been only ten of Mesklin's years since alien education had started for a selected few of its natives; this human being must be five years old or younger. Of course, there was no telling what that

might mean in the way of maturity for his species, and one could not very well ask; but in spite of the aura of supernormality which tended to surround all the aliens, one just did not think of a five-year-old as a superior being.

As relaxed as anyone could well be on a floor with a sixty-degree tilt, the sailor began his description of the *Kwembly's* situation. He gave a detailed account of the trip down what now had to be recognized as a river, and of its conclusion. He described minutely what could be seen from the bridge. He explained how they were stranded off their tracks, and emphasized the situation which faced the crew if this could not be corrected. He even detailed the structure of the air locks, and explained why the main one was probably unusable and the others possibly so.

"It will help a great deal in the captain's planning," he concluded, "if we can have some trustworthy estimate of what will happen to this river, and especially whether and when it will run dry. If the whole snowfield melts at this season and runs off the plateau through this one drain, I suppose we're here for the best part of a year and will have to plan accordingly. If you can give any hope that we can work on dry land without having to wait too long, though, it would be very good to know."

Benj was rather longer than sixty-four seconds in answering this; he, too, had been given material for thought.

"I have your details on tape, and have sent it up to Planning," his words came through at last. "They'll distribute copies to the labs. Even I can see that figuring out the life story of your river is going to be a nasty job; maybe an impossible one without a lot more knowledge. As you say, the whole snowfield might be starting a seasonal melt, and if the area of North America has to drain through one river you're there for a long time. I don't know how much of the place your aerial scout reports cover, and I don't know how ambiguous the photos from up here may be, but I'll bet when it's all down on maps there still will be room for argument. Even if everyone agrees on a conclusion—well, we still don't know much about that planet."

"But you've had so much experience with other planets—many of them!" returned Beetchermarlf. "I should think that would be of some help."

Again the answer was longer in coming back than light-lag alone would explain.

"Men and their friends have had experience on a lot of planets, that's true, and I've read a good deal of it. The trouble is, practically none of it helps here. There are three kinds of planet, basically.

One we call Terrestrial, like my own home; it is small, dense, and practically without hydrogen. The second is the Jovian, or Type Two, which tend to be much larger and much less dense because they have kept most of their hydrogen from the time they originally formed—we think. Those two were the only kinds we knew about before we left our own star's neighborhood, because they are the only kinds in our system.

"The Type Three is very large, very dense, and very hard to account for. Theories which had the Type One's losing their hydrogen because of their initially small mass, and the Two's keeping theirs because of their greater mass, were fine as long as we'd never heard of the Three's. Our ideas were perfectly satisfactory and convincing as long as we didn't know too much, if you'll forgive my sounding like my basic science teacher.

"Type Three is the sort you're on. There are none of them around any sun with a Type One planet—I suppose there must be a reason for that, but I don't know what it is—so nothing was known about them by any of the Community races until we learned to travel between stars and began to do it on a large scale—large enough so the principal interest of wandering ships wasn't just new habitable planets. Even then we couldn't study them firsthand, any more than we could the Jovian worlds;

we could send down a few special, very expensive and usually very unreliable robots, but that was all. Your species is the first we've ever encountered able to stand the gravity of a Type Three—or the pressure of a Type Two, for that matter."

"But isn't Mesklin a Type Three, by your description? You must know a lot about it by now; you've been in touch with our people for something like ten years, and some of you have even landed at the Rim—I mean the equator."

"More like fifty of our years. The trouble is that Mesklin isn't a Type Three. It's a peculiar Two. It would have had all the hydrogen of any Jovian world if it hadn't been for its rotation—that terrific spin which gives your world an eighteen-minute day and a shape like a fried egg. There aren't any others like it which we've found yet, and no intermediate cases that anyone's recognized, or at least that I've heard of. That's why the Community races were willing to go to so much trouble and effort and spend so much time building up contact with your world and setting up this expedition to Dhrawn. We'll find out a good deal in thirty years or so about that world's makeup from the neutrino counters in the shadow satellites, but the seismic equipment you people have been planting will add a lot of detail and remove a lot of ambiguity. So will your

chemical work. In five or six of your years we may know enough about that rock ball to make a sensible guess why it's there, or at least whether it ought to be called a star or a planet."

"You mean you only made contact with the people of Mesklin so you could learn more about Dhrawn?"

"No, I didn't mean that at all. People are people, and worth getting to know for their own sake—at least, both my parents feel that way, though I've met folks who certainly don't. I don't think the idea for the Dhrawn project got started until long after your College was under way, though my mother, or Dr. Aucoin, could tell you more exactly—all that was long before I was born. Of course, when it dawned on someone that you folks *could* make first-hand investigation of a place like Dhrawn, everyone jumped at the chance."

This, of course, forced Beetchermarlf to ask a question which he would ordinarily have regarded as a strictly human affair and none of his business, like the matter of how mature a five-year-old should be. It slipped out before he caught himself, however; and for over an hour thereafter he and Benj were arguing over the reasons for such activities as the Dhrawn project—why such a vast amount of effort should be devoted to an activity with no obvious material return in

prospect. Benj did not defend his side too well. He was able to give the usual answers about the drive of curiosity, which Beetchermarlf could see up to a point; he knew enough history to have heard how close man and several other species had come to extinction from energy starvation before they had developed the hydrogen fusion converter; but he was too young to be really eloquent. He lacked the experience to be able to point out convincingly, even to himself, the complete dependence of any culture on its understanding of the laws of the universe. The conversation never became heated, which would have been difficult in any argument where there is a built-in cooling-down period between any remark and its answer; but the only really satisfactory progress made was in Benj's mastery of Stennish.

The discussion was interrupted by Beetchermarlf suddenly becoming aware of a change in his surroundings. For the last hour his entire attention had been on Benj's words and his own replies; the canted bridge and gurgling liquid had receded to the far background of his mind. He was quite surprised to realize abruptly that the pattern of lights twinkling above him was Orion. The fog had gone.

Alert once more to his real surroundings, he noticed that the water line around the bridge seemed just a trifle lower. Ten minutes'

careful watching convinced him that this was so. The river was falling.

Part way through the ten minutes he had, of course, been queried about his sudden silence by Benj, and had given the reason. The boy had immediately notified McDevitt, so by the time Beetchermarlf was sure about the changing water level there were several interested human beings on hand above to hear about it. The helmsman reported briefly to them on the radio, and only after doing this did he call through the speaking tubes for Dondragmer.

The captain was far aft, behind the laboratory section and just forward of the compartment containing the pressure bladder, when the call came. There was a pause after the helmsman finished speaking, and Beetchermarlf expected the captain to come bursting through the bridge hatchway after a few seconds; but Dondragmer did not yield to the temptation. The ports in the rest of the hull, including the compartment where he was, were much too small to permit a clear estimate of the water level, so he had to accept his helmsman's judgment. Dondragmer was willing to do this, rather to the young sailor's surprise.

"Keep track as exactly as you can of the rate of fall, until you are relieved," was his order. "Let me and the human beings know the rate as soon as you can guess it

reliably, and thereafter whenever you change your estimate."

Beetchermarlf acknowledged the order and clambered across the bridge to a point where he could mark the water line with a scratch on one of the window stanchions. He reported the action to the captain and the human listeners, and returned to his station with his eyes fixed on the mark. The ripples in the liquid were several inches high, settling down only at rare intervals, so it was some time before he could be at all sure of the change in depth. There were two or three impatient queries from above, which he answered politely in the best he could muster of his limited human language, before Benj reported that he was once more alone except for nonentities watching other cruisers. Most of the time thereafter, until Takoorch arrived as bridge relief, was spent by the two in describing their home worlds, correcting each other's misconceptions about Earth and Mesklin by way of language practice, and, though neither was fully aware of it, developing a warm personal friendship.

Beetchermarlf returned six hours later to let Takoorch go—actually the interval was twenty-four days by Mesklinite reckoning, a standard watch length—and found that the water was down nearly a foot from his reference mark. Takoorch informed him that the

human Benj had just returned from a rest period. The younger helmsman wondered privately just how soon after Tak's arrival the other had found it was time to take a rest. Naturally he could not ask such a question, but as he settled back into his station he sent a call radiating upward.

"I'm back on, Benj. I don't know how recently Tak made a report to you, but the water is down over half a body length and the current seems much slower. The wind is nearly calm. Have your scientists anything to report?"

He had time during the answer delay to realize that the last question had been rather pointless, since the principal news wanted from the human scientists was the probable duration of the river, but there was nothing to be done about it now. Besides, maybe they *did* have something of value.

"Your friend Takoorch did tell us about the water and wind, among a good many other things," Benj's voice announced. "It's good to have you back, Beetch. I haven't heard anything from the labs, but it seems to me from what you've said about the way you're tipped and the rate the water's been dropping, and from what I can judge from the cruiser model I have here, that another sixty or seventy hours should leave you dry. That's if the water keeps dropping at the same rate, of course. It might do that if it's flowing away through a

nice smooth channel, but I wouldn't count on that. I hate to sound pessimistic, but my guess is that it will slow down before all the liquid is gone."

"You may be right," agreed Beetchermarlf. "On the other hand, with the current easing off we can probably work outside safely enough before it's all gone." This was a prophetic remark. It was still on its way to the station when a speaking tube hooted for attention.

"Beetchermarlf! Inform the human beings that you will be relieved immediately by Kervenser, and report at once to the starboard after emergency lock in your air-suit. I want a check of the trucks and tiller lines. Two others will go with you for safety. I am more interested in accuracy than speed. If there is any damage which would be easier to fix while we are still tilted than it would be after we are level, I want to know about it. After you make that specific inspection, take a general look around; I want a rough idea of how solidly we are wedged into this position and how much work it will take to level us and get us loose. I will be outside myself making a similar check, but I want another opinion."

"Yes, sir," the helmsman responded. He almost forgot to notify Benj, for this time the order was a distinct surprise—not the fact that he was to go outside, but

that the captain had chosen him to check his own judgment.

The airsuits had been removed when Dondragmer was convinced that the hull was sound, but Beetchermarlf was back into his in half a minute and at the designated lock moments later. The captain and four sailors, all suited, were waiting. The crewmen held coils of rope.

"All right, Beetch," greeted the captain. "Stakendee will go out first and attach his line to the handiest climbing grip. You will follow, then Praffen. Each of you will attach his line to a different grip. Then go about your assignments. Wait—fasten these to your suit harness; you'll float without ballast." He handed four weights equipped with quick-release clips for harness attachment to the helmsman.

Egress was made in silence through the tiny lock. It was essentially a U-shaped liquid trap, fundamentally similar in operation to the main one and deep enough so that the *Kwembly's* tilt did not quite spoil its operation. The fact that the outer end was in liquid anyway may have made the difference. Beetchermarlf, emerging directly into the current, was glad of Stak's steadying grip as he sought anchorage for his own safety line.

A minute later the third member of their group had joined them, and together they clambered the

short distance that separated them from the river bottom. This was composed of the rounded rocks which had been visible from the bridge, arranged in an oddly wave-like pattern whose crests extended across the direction of the current. At first glance, Beetchermarlf got the impression that the cruiser had stranded in the trough between two of these waves. Enough of the outside lights were still working to make seeing possible, if not quite ideal.

The trio made their way around the stern to get a look at their vehicle's underside; and while this was much less well lighted, it was obvious at once that there would be a great deal to report to Don-dragmer.

The *Kwembly* had been supported by a set of sixty trucks, each some three feet wide by twice as long, arranged in five longitudinal rows of twelve. All swiveled on casters, and were interconnected by a maze of tiller ropes which were Beetchermarlf's main responsibility. Each of the trucks had a place to install a power unit, and had its own motor consisting of a six-inch-thick shaft whose micro-structure gave it a direct grip on the rotating magnetic field which was one of the forms in which the fusion units could deliver their energy. If no power box was installed, the truck rolled free. At the time of the accident, ten of the *Kwembly's* twenty-five converters

had been on trucks, arranged in point-forward V patterns fore and aft.

Eighteen trucks from the rear of the cruiser, including all five of the powered ones at that end, were missing.

V

Strictly speaking, all of them weren't missing. Several could be seen lying on the boulders, evidently dislodged at the time of the final impact. Whether any had gone with the earlier bumps, presumably miles upstream, Beetchermarlf could not guess and was rather afraid to find out. That could be checked later. Inspecting what was left would have to come first. The helmsman set to it.

The front end seemed to have sustained no damage at all; the trucks were still present and their maze of tiller lines in proper condition. Amidships, many of the lines had been snapped in spite of the enormous strength of the Mes-klinite fiber used in them. Some of the trucks were twisted out of alignment—several, indeed, swung freely to the touch. The pattern of missing parts aft was regular and rather encouraging. Numbering from the port side, Row 1 had lost its last five trucks, Rows 2 and 3 their last four, Row 4 the last three, and Row 5, on the starboard side, its last two. This suggested that they had all yielded to

the same impact, which had wiped diagonally across the bottom of the hull; and since some of the detached units were in the neighborhood, there seemed a good chance that they all would be.

The inspectors were surprised at how little damage had been done by tearing the trucks away. Beetchermarlf and his companions had had nothing to do with the design of the *Kwembly* and her sister machines; none of them had more than the roughest idea of the sort of thinking which had been involved. They had never considered the problems inherent in building a machine powered by the most sophisticated energy sources ever developed, but operated by beings from a culture still in the muscle-and-wind stage; beings who would be cut off from *any* repair and replacement facilities once they were on Dhrawn. This was the reason the steering was done by tiller and rope rather than by powered selsyns, or similar devices; why the air locks were so simple, and not completely foolproof; why the life-support system was not only manually operated, except for the lights which kept the plants alive, but had been designed and built by Mesklinite scientists and technicians.

A few hundred of the beings had received an extensive body of "alien" education, though no attempt had been made to spread the new knowledge through the Mes-

klinite culture. Nearly all of the "college graduates" were now on Dhrawn, together with recruits like Beetchermarlf—mostly young, reasonably intelligent volunteers from among the sailors of Barlennan's maritime nation. These were the people who would have to perform any repairs and all regular maintenance on the land-cruisers, and this fact had to be kept constantly in the foreground of the designers' minds. Designing vehicles capable of covering thousands of miles of Dhrawn's environment in a reasonable length of time, and at the same time reasonably safely under Mesklinite handling, had inevitably resulted in equipment with startling qualities. Beetchermarlf should not have been surprised that the pieces of his cruiser went back together so readily, and had suffered so little damage.

Of course, the intelligence of the Mesklinites had been taken into account—it was the whole reason for not depending on robots, unsatisfactory as these had proved in the early days of space exploration. That intelligence was obviously comparable to that of the average human being, Drommian, or Paneshk—a fact surprising in itself, since all four planets appeared to have been evolving their life forms for widely differing lengths of geological time. It was also fairly certain that Mesklinites were much longer-lived on the average than human beings, though they were

oddly reluctant to discuss this point, and what this would mean in terms of their general competence was an even shakier guess than the ones about Dhrawn itself. It had been a risky project from all angles, with most of the risk being taken by the Mesklinites. The giant barge drifting in orbit near the human station, which was supposed to be able to evacuate the entire Settlement in emergency, was little more than a gesture—especially for the beings afield in the land-cruisers.

None of this was in the minds of the three sailors inspecting the *Kwembly's* damage. They were simply surprised and delighted to find that the lost trucks had merely popped out of the sockets in which they normally swiveled and into which they could apparently be replaced with little trouble, provided they could all be found. With this settled to his satisfaction, Beetchermarlf made a brief cast over the river bottom to the limits imposed by the safety lines, and found twelve of the trucks within that radius. Some of these were damaged—tracks broken or with missing links, bearing wheels cracked, a few axles bent. The three gathered together all the material they could reach and transport, and brought it back to the *Kwembly's* stern. The helmsman considered doubling up on the safety lines and increasing their search radius, but decided to report

to Dondragmer and get his approval first. As a matter of fact, he was a little surprised that the captain had not appeared earlier, in view of his announced intention to check outside.

He found the reason when they went back around the stern to the lock. Dondragmer, his two companions of the original sortie, and six more crewmen who had evidently been summoned in the meantime were near the middle of the *Kwembly* laboring to remove boulders from the region of the main air lock.

The breathing suits had no special communication equipment, and the transmissive matching between their hydrogen-argon filling and the surrounding liquid was extremely poor; but the Meskline voice—built around a swimming siphon rather than a set of lungs, since the hydrogen-using midguts lacked the latter—was another thing which had bothered human biologists. The helmsman caught his captain's attention with a deep hoot, and gestured him to follow around the stern of the cruiser. Dondragmer assumed that the matter was important and came along, after directing the others to continue their work. One look and a few sentences from Beetchermarlf brought him abreast of the situation.

After a few seconds' thought he disapproved the suggestion of looking immediately for the missing

trucks. The water was still going down; it would be safer and easier to conduct the search when it was gone, if this did not take too long, and in the meantime repairs could be started on the ones which had already been found. Beetchermarlf acknowledged the order and began to sort over the damaged equipment in order to plan the work.

Care was necessary; some parts were light enough to be borne away by the current when detached from the rest of the assemblies. Some such items were already missing, and had presumably gone in just that fashion. The helmsman had a portable light brought to the scene and stationed one of his helpers a few yards downstream to catch anything which got away from him. He thought how helpful a net would be, but there was no such item aboard the *Kwembly*. It would be possible to make one from the miles of cordage she carried, but it hardly seemed worth the time.

Eight hours of labor, interrupted by occasional rests spent chatting with Benj, saw three of the damaged trucks again serviceable. Some of their parts were not of the original quality, Beetchermarlf and the others having improvised freely. They had used Mesklinite fabric and cord, and alien polymers and alloys which were on hand. Their tools were their own; their culture had high standards of craftsmanship, and such things as

saws, hammers, and the usual spectrum of edged tools were familiar to the sailors. The fact that they were made of the Mesklinite equivalents of bone, horn, and shell was no disparagement to them, considering the general nature of Mesklinite tissue.

Replacing the repaired units in their swivels took muscle even by Mesklinite standards. It also took more tool work, as metal in the mountings had been bent out of shape when the trucks were torn free. The first three had to be placed in Row 4, since Row 5 was pressed against the boulders of the river bottom and the other three were too high to be reached conveniently. Beetchermarlf bowed to necessity, attached the trucks where he could, and went back to fixing more.

The river continued to fall and the current to decrease. Dondragmer ordered the helmsman and his helpers to move their work area from beneath the hull, suspecting what would happen as the buoyant force on the *Kwembly* decreased. His caution was justified when, with a grinding of boulders, the vehicle slipped from its sixty-degree tilt to about thirty, bringing two more rows of trucks within reach of the bottom and forcing two workmen to duck between stones to avoid being crushed.

At this point it became obvious that even if the water fell farther, the cruiser would not. A point on

its port underside about a third of the way back from the bow and between Rows 1 and 2 was now resting on a single rock some eighteen feet in diameter and half buried in the river bottom—a hopeless object to dislodge even without the *Kwembly's* weight on it.

Beetchermarlf kept on with his assigned job, but couldn't help wondering how the captain proposed to lift his command off that eminence. He was also curious about what would happen when, and if, he succeeded. The cobbly surface which formed the riverbed was the last sort of thing the cruiser's designers had had in mind as a substrate, and the helmsman doubted seriously that she could run on such a base. High-gravity planets tend to be fairly level, judging by Mesklin as the only available example; and even if an area were encountered where traction seemed unpromising, the designers must have supposed that the crew need merely refrain from venturing onto it. This was another good example of the reason manned exploration was generally better than the automated kind.

At least, one could hope so. Beetchermarlf, in a temporarily philosophical mood, reached the conclusion that foresight was likely to depend heavily on the amount of hindsight available.

Dondragmer was pondering the same problem, about getting his

vehicle free, and at the time—some fifty hours after the stranding—was no nearer a solution than his helmsman. The first officer and the scientists were equally baffled. They were not worried, except for the captain, and even his feeling did not exactly parallel human “worry.” He had kept to himself and Beetchermarlf, who had been on the bridge at the time, a conversation he had had with the human watchers a few hours before.

It had begun as a regular progress report, on an optimistic tone. Dondragmer was willing to admit that he hadn't thought of a workable plan yet, but not that he was unlikely to think of one. Unfortunately, he had included in the remark the phrase “we have plenty of time to work it out.”

Easy, at the other end, had been forced to disagree.

“You may not have as much as you think. Some of the people here have been considering those boulders. They are round, or nearly so, according to your report and from what we can see on the bridge set. The most likely cause of that shape, according to our experience, is washing around in a stream bed, or on a beach. For rocks that big to be moved implies a tremendous current. We're afraid that the stream which carried you there is just a preliminary trickle—the first thaw of the season—and if you don't get away soon you'll face a lot more water coming down.”

Dondragmer had considered briefly.

"All right, but we're already doing all we can. Either we get away in time, or we don't; we can't do better than our best. If your scientists can give any sort of specific forecast of this super-flood, we'll be glad of it, of course; otherwise we'll have to go on as we are. I'll leave a man on the radio here, unless I have too much for them to do; in that case, try the lab. Thanks for the information."

The captain had gone back to work and to thought. He was not the type to panic; in emergencies he seemed calmer than in a personal argument. Basically, his philosophy was the one he had just expressed—to do all one could in the time available, with the full knowledge that time would run out some day. At the moment, he only wished he knew what was "all he could do."

The big rock was the central problem. It was keeping the drivers from traction, and until they not only touched bottom, but bore heavily on it, there was no moving the *Kwembly* with her own power. She might conceivably have been shifted by muscle power at Mesklin's Rim, or more likely on Earth, but not under Dhrawn's gravity. Even a two-foot boulder was hard to move in that field.

There was rigging inside which could be set up as lifting tackle,

but none of it could begin to support the vehicle's weight as a static load even if its mechanical advantage were adequate.

Of course some trucks—four, to be exact—were in contact with the troublesome rock itself, and several more in Row 5 were touching the bottom. None of these was powered at the moment, but converters could be transferred to them. If the four on the rock, and the ones forward from them, and some of the Row 5 trucks, were all to be powered why couldn't the cruiser simply be backed off?

She could. No reason at all to doubt it. On level ground with reasonable traction any four well-spaced power units could drive her. With her weight concentrated on only a few trucks, traction should be better than normal; and a backward move would be essentially downhill.

It was not lack of self-confidence which caused Dondragmer to outline this plan to the human being on communication watch; he was announcing his intentions, not asking for advice. The man who heard him was not an engineer, and gave casual approval to the move; but as a matter of routine he reported the situation to Planning so that the information could be distributed. Consequently it reached an engineer within an hour or so, long before Dondragmer was ready to execute his plan.

It caused a raising of eyebrows, a quick examination of a scale model of the *Kwembly*, and two minutes of rapid slide-rule work.

The engineer was a poor linguist, but this was not the only reason he went looking for Easy Hoffman. He did not know Dondragmer very well, had no idea how the Mesklinite would react to criticism—he had worked with Drommians, since there were some connected with the Dhrawn project—and he felt it safest to have his point presented by the official oil-spreader. Easy, when found, promptly assured him that she had never known Dondragmer to resent reasonable advice, but agreed that her better knowledge of Stennish would probably help even though the captain was fluent in the human tongue. They went together to the communication room.

Benj was there, as usual when he was not actually on duty. He had by now made friends with several more of the Mesklinites, though he still liked Beetchermarlf best. The latter's long work hours resulting from the accident had not entirely prevented them from conversing, and Benj's Stennish had improved greatly; he was now almost as good as his mother believed.

When Easy and the engineer arrived, he was talking with—or rather, listening to—Takoorch, and was not too sorry to interrupt the

exchange with the news that there was an important message for the captain.

It took several minutes to get Dondragmer to the bridge; like the rest of the crew he was working almost constantly, though by luck he happened to be inside when the call came.

"I'm here, Easy," his voice finally came through. "Tak said you had a business call. Go ahead."

"It's about this way you plan to back off the rock, Don," she began. "We don't have the whole picture here, of course, but there are two things bothering our engineers. One is the fact that your forward truck will run off the stone while you still have ten feet or more of hull, including some of your bridge, over it. Have you measured to see whether there's any risk of bare hull slamming down on the stone as the truck rolls off? Also, toward the end of the maneuver, you'll have your hull supported almost entirely at the ends. The pneumatic undercarriage may distribute the load, but my friend here isn't sure it will; and if you get the bare hull instead of the mattress taking half the *Kwembly*'s weight, Dhrawn's gravity is going to make a very respectable effort to break your land-ship in half. Had you checked those points?"

Dondragmer had to admit to himself that he had not, and that he had better do so before the

project went much further. He conceded this on the radio, thanked Easy and her friend, and headed for the main lock—long since cleared for use.

Outside, the current had dropped to the point where lifelines were no longer necessary. Water depth was down to about seven feet, measured from the average level of the smallest boulders. The water line was, indeed, at about the most inconvenient possible level for seeing the whole picture which he wanted. He had to climb part way up the rock—a difficult task in itself, though helped by the fact that he had some buoyancy for the steepest part—and from there along the forward trucks to a point where he could compare the curvature of the big boulder and that of the *Kwembly's* lower bow. He could not be completely sure, since moving the hull backward would obviously change its pitch angle but he did not like what he saw. The human engineer, it seemed, was probably right. Not only was there risk of hull damage, but the steering bar came through the hull just ahead of the mattress by means of a nearly air-tight mechanical seal backed by a liquid trap, and made its key connections with the maze of tiller ropes. Serious damage to this would not actually cripple the vehicle, since there was a duplicate bar aft, but it was not a risk to be taken casually.

The answer to the whole situation was staring him in the face by that time, but he was another hour or more in seeing it. A human psychologist, when he heard about this later, was very annoyed. He had been looking for significant differences between human and Mesklinite minds, and was finding what he considered an undue number of points of similarity.

The solution involved work, of course. Even the smallest boulders were heavy. Still, they were numerous, and it was not necessary to go far for a plentiful supply. With the entire crew of the *Kwembly* at the job, except for Beetchermarlf and those still helping him with the trucks, a ramp of piled stones grew with fair speed from the stern of the trapped vehicle toward the key rock.

It was a help to Beetchermarlf. As fast as he readied a damaged bearing unit for service, he found himself able to get at new installation sites which had been out of reach before. He and the stone-carriers finished almost together, allowing for four trucks which he had been unable to repair because of missing parts. He had made thrifty use of these, cannibalizing them for the needs of some of the others, and had spotted the unavoidable gaps in traction widely enough to keep the cruiser's weight reasonably well distributed. To work on Row 5, practically buried in the river bottom, he had had to

deflate that part of the mattress. Pumping it up again when the two trucks were replaced caused the hull to shift slightly, to the alarm of Dondragmer and several workers underneath, but fortunately the motion was insignificant.

The captain had spent most of the time shuttling between their radio, where he kept hoping for a reliable prediction of the next flood, and the work site where he divided his attention between the progress of the ramp and the view upstream. By the time the ramp was complete the water was less than a yard deep, and the current had ceased entirely; they were in a pool rather than a stream.

It was now full night; the sun had been gone for nearly a hundred hours. The weather had cleared completely, and workers outside could see the violently twinkling stars. Their own sun was not visible; it was barely so at the best of times this deep in Dhrawn's heavy atmosphere, and at the moment was too close to the horizon. Not even Dondragmer knew offhand whether it was slightly above or slightly below. Sol and Fomalhaut, which even the least informed of the crew knew to be indicators of south, glowed and wavered over a low eminence a few miles in that direction. The imaginary line connecting the two had tilted less than twenty degrees—human scale; the Mesklinite

navigators would have said less than four—since dark.

Outside the range of the *Kwembly's* own lights it was almost totally black. Dhrawn is moonless, and the stars provide no more illumination than they do on Earth or Mesklin.

Temperature was nearly the same. Dondragmer's scientists had been measuring the environment as completely as their knowledge and equipment allowed, and sending the results to the station above. The captain had been quietly hoping for some personally useful return, though he realized that the human beings didn't owe him one. The reports, after all, were simply part of the job the Mesklinites had engaged to do in the first place.

He had also suggested to his own men that they try some independent thinking. Borndender's answer to what he regarded as sarcasm had been to the effect that if the human beings would supply him with reports from other parts of Dhrawn and with computer time with which to correlate them, he would be glad to try. The captain had not intended sarcasm; he knew perfectly well the vast difference between explaining why a ship floats on water or ammonia and explaining why 2.3 millicables of 60-20 rain fell at the Settlement between Hour 40 and Hour 100 of Day 2. He suspected that his researcher's misinterpretation had been deliberate; Mesklinites were

often quite human when in search of excuses, and Borndender was currently feeling annoyed with his own lack of usefulness. Without bringing this aspect of the matter into the open, the captain merely repeated that useful ideas would be welcome, and left the lab.

Even the scientists were ordered outside when the time finally came to use the ramp. Borndender was irritated at this, and muttered something as he went about the academic nature of the difference between being inside the *Kwembly* and outside her if anything drastic happened. Dondragmer, however, had not made a suggestion; he had issued an order, and not even the scientists denied either his right, or his competence to do so. Only the captain himself, Beetchermarlf, and a technician named Kensnee in the life-support compartment were to be aboard when the start was made.

Dondragmer had considered acting as his own helmsman and taking a chance on the life equipment, but reflected that Beetchermarlf knew the tiller cable layout better and was more likely to sense anything going wrong in that department. Inside power was not directly concerned with motion, but if any slip or collapse of the ramp caused trouble with the life support system it was better to have someone on hand; this was even more important than the cruiser, since it was conceivable

that the crew could walk back to the Settlement carrying the air equipment even if the cruiser herself were ruined.

The same logic which caused the evacuation order should, of course, have implied that Beetchermarlf and Kensnee be the only ones aboard, with the captain also watching from outside, but Dondragmer was not prepared to carry the logic that far.

The crowd of caterpillarlike beings gathered outside the monster hull was human enough to show tension as the drivers took up the slack in their treads. Dondragmer could not see the phenomenon from the bridge, and was calmer; Beetchermarlf could feel it, and was more perturbed. The human watchers, able to observe from a set which had been taken from the life-support room and placed on a rock projecting from the water a hundred yards from the land-cruiser, could see nothing until the latter actually started to move; they were all calm except Easy and Benj.

The boy was devoting little of his attention to the outside view, in fact; he watched the bridge screen on which part of Beetchermarlf could be seen. The helmsman had one set of chelae on the tiller, holding rather than manipulating it; the other three were darting with almost invisible speed among the grips of the engine-control

lines, trying to equalize the pull of the different trucks. No attempts had been made to power more than the usual ten, but the cords which normally cross-connected them so that a single line would work them all had been realigned for individual control. Beetchermarlf was, therefore, very, very busy.

As the *Kwembly* began to inch backward, one of the human beings was moved to comment:

"Why in blazes didn't they put remote controls, or at least torque and thrust indicators, on that bridge? That poor bug is going crazy. I don't see how he can tell when a particular set of tracks is even gripping, let alone how it responds to his handling."

"If he had fancy indicators, he probably couldn't," replied Mersereau. "Barlennan wanted no more sophisticated gear on those vehicles than his people could repair on the spot, except where there was really no choice. I agreed with him, and so did the rest of the planning board. Look—she's sliding off, smooth as ice."

A chorus of expressive hoots came from the speaker, muffled by the fact that most of the beings emitting them were under water. For a long moment, a score or so of the 'midship trucks were hanging free as the stern of the *Kwembly* came off the ramp and moved back over the riverbed. The engineer who had been afraid of

the bridge effect crossed his fingers and rolled his eyes upward. Then the bow dipped as the forward trucks came down onto the ramp in their turn, and weight was once more decently distributed. The twisting stress, which no one had considered seriously, lessened as the cruiser eased onto the relatively level cobbling of the riverbed and came to a halt. The crew divided and poured around bow and stern to get to the main lock, no one thinking to pick up the communicator. Easy thought of reminding the captain, but decided that it would be more tactful to wait.

Dondragmer had not forgotten the instrument. As the first members of the crew emerged from the inner surface of the lock pool, his voice echoed through the speaking tubes.

"Kervenser! Reffel! Take the scout fliers out at once. Reffel, pick up the communicator outside—make sure the shutter is in the flier before you start—and then make a ten-minute sweep north to east and back. Kervenser, sweep west and around to south for the same time. Borndender, report when all your measuring equipment is aboard. Beetchermarlf and Takoorch, outside and realign the engine control cords to normal."

His communicator at the bridge had the sound on, so Easy heard and translated these orders, though the reference to a shutter meant nothing to any of them. She and

the others watched with interest the screen of the outside set as the two tiny helicopters rose from the upper lock, one of them sweeping toward the pickup and presumably settling outside its field of view. The other was still climbing as it left the screen, heading west. The picture rocked as the set was picked up by Reffel and wrestled into its space aboard the flier; Easy flicked a switch absently to record the scenes for future use.

Dondragmer would have appreciated being able to watch the same screen, but could wait only for a relayed verbal report from Reffel, or a delayed but direct one from Kervenser. Actually, Reffel did not bother to relay. The ten-minute flights produced no information demanding speedy delivery. What it amounted to, as Dondragmer duly reported to the human audience, was that the *Kwemby* was in a valley some fifteen miles wide, with walls of bare rock which were quite steep by Dhrawn's standards; the pilots estimated twenty to thirty degrees. They were also remarkably high, fully forty feet. To the west there had been no sign of a new flood as far as Kervenser had flown, though he had noted that the boulders strewing the valley floor gave way to bare rock in that direction within a mile or two, and there were numerous pools like the one in which the *Kwemby* was now standing. To the east, the

stones and pools continued as far as Reffel had gone. Dondragmer pondered for a while after relaying this information to the satellite, then ordered one of the fliers back to work.

"Kerv, get back aloft. The helmsmen won't be done for hours yet. Go as far west along the valley as you can in an hour, and check as closely as your lights will allow for any sign whatever of more water starting down. No, make that three hours—unless you get a positive finding, of course, or have to turn back for bad visibility. I'm going off watch. Tell Stakendee to take the bridge before you leave."

Even Mesklinites get tired, but Dondragmer's supposition that this was the right time to get some rest was an unfortunate error, as Barlennan pointed out to him later. When the captain insisted that there would have been nothing for him to do even if he had been fully alert, his superior gave the equivalent of a snort of contempt.

"You'd have managed. You did later."

Dondragmer refrained from pointing out that this proved that his omission was hardly a serious error.

It was almost eight hours after Kervenser's departure that a crewman reported to Dondragmer.

"Sir, Kervenser and the helmsman are still outside, and the pool of water we're in has frozen."

To Be Continued

*The electric eel of South America
(which isn't an eel) represents one line of biological
use of electricity—but it's neither
completely unique, nor is shocking the only use
organisms can make of electricity.
After all, we use a lot of electric sensors—and
so do animal life forms!*

CARL A. LARSON

bioelectric phenomena

Sauntering through a little trafficked lane you become wide-awake when two half-formed shadows materialize and bear down on you with a threat of violence. Still barely aware of your danger you release two swift kilowatt discharges, stunning the assailants. In every similar situation you are safe, thanks to your innate ability to discharge at will voltages sufficient to stun or kill any man-sized adversary. You can do that if you are an electric eel.

Bioelectric phenomena are everywhere in the plant and animal kingdoms, the forces of evolution have used them in different ways to enhance the chances of survival.

Given half an hour with his scrap heap and a soldering iron somebody you know could outdo with electricity most everything Nature can do, but we must hand it to selective forces that they were early inventors. When at long last bioelectric events caught the attention of scientists, two hundred years of research and speculation went into the attempt to understand what was once called "animal electricity."

The story of this attempt is brief and sometimes droll, the chronicle of mistakes by natural forces is long and cataclysmic. Was it a mistake, by our early ancestors, not to keep and develop the electric po-

tential differences coming forth in some primitive vertebrate structures? What a boon to early man to be able to spark his fire, animate his lazy women and perhaps illuminate his cave with the aid of self-made electricity. What about ion propulsion from innate batteries when private enterprise goes into outer space? There are other sides to the possible blunders by evolution. But first to the shorter story of modern man and animal electricity.

It all began with Lucia Galvani preparing a tasty soup. Having killed and skinned the frogs she saw something uncanny. As she excitedly told her husband, the legs of the dead frogs were all twitching. Did it have something to do with the electricity machine he had left on the kitchen table? Luigi Galvani put two and two together and started a series of experiments the final result of which you carry under your car hood. Crucial for the invention of galvanic cells was the demonstration, by the learned Bologna professor, that frogs legs twitched, not only when stimulated by electricity from a charged capacitor (Leyden jar) or, via a lightning conductor from a thunderstorm, but also when fixed by brass wire to an iron rail.

Why the last experiment? Just a preparation to test atmospheric electricity—but none was needed, the muscles twitched as soon as the

dissimilar metals were connected via the fresh tissue. Thus no external source of electricity was needed, Galvani concluded. He thought muscles contracted when a metallic conductor connected them with nerve tissue, because a channel was thus established for the flow of stored animal electricity.

Galvani knew about electric fishes, a systematic study of their properties had been introduced by John Walsh. But when Galvani published, in 1791, his famous work on electric forces in muscular movement, animal electricity appealed to minds prepared by a more spectacular forerunner.

The name of this forerunner was tainted, but the animal magnetism he broached had lost little of its attraction. Back in 1766 Franz Anton Mesmer got his M.D. in Vienna on a thesis about the influence of the planets upon human health. Certainly it was not this work that earned him the distinction of entering Webster with four nouns, one adjective and a verb all derived from his surname. He theorized that the human nervous system is subject to gravitational forces, possible to influence by applying magnets to diseased parts of the body. Soon he found his theories worked with alarming success. He cured the sick with his magnets and patients came to him from abroad.

Next, Mesmer found his unequipped hand was equally effective;

he had discovered animal magnetism, he proclaimed. This non-mineral magnetism had its seat in his body, magnets and metallic rods just passed it over to the patient. He extended his ministrations to mental patients, claiming he could cure them. The rational climate of Vienna was inhospitable to charlatans and at this juncture Mesmer had to take a hurried leave. He went to Paris, won the protection of Queen Marie Antoinette and entertained languid socialites with séances in a parlor curtained to semidarkness. Here his patients reposed, primed by rumor and scraps of Mesmer's elaborate doctrine and exposed to cords and wonder-working hardware, waiting for the soft music that preceded the master's appearance. Draped in a silken robe he made his entrance, moved slowly from one patient to another, touching them with his hands, or his long iron wand.

In 1784 King Louis XVI appointed a Royal Commission to have a close look at Mesmer's claims and activities. They were certainly viewed in all their aspects, the Commission included: the astronomer Bailly; the chemist Lavoisier; the inventive philanthropist, Dr. Guillotin; and an exceptionally well-informed minister plenipotentiary from a young Nation, Benjamin Franklin. To Mesmer their verdict was disastrous, there was no such thing as animal magnetism.

Mesmer was on his way into obscurity when Galvani's report was published. If Parisian aristocrats were about to be freed from their languor, it was without benefit of animal magnetism. In England practitioners of animal electricity and magnetism were at large, and on the European continent minds were prepared: animal electricity was Something—a bone of contention for doctors; perhaps the dimly understood healing force of Nature.

No mental preparation of that sort was needed for Alessandro Volta to understand and appreciate his friend Galvani's paper. At this time Volta was a well-known professor in Pavia, who had more or less discovered electrostatic induction, and thought he had made his mark when he had an interview with Franklin. Now Volta repeated Galvani's experiments. They were indeed wonderfully reproducible and many years of careful research sustained the published report. Though Volta found the idea of animal electricity vague and obscure he soon found it was there. It worked and he became enthusiastic over it.

But what was this about two different metals in the circuit? Galvani had used brass hooks and an iron railing to make frogs legs twist. It was not at all the same, using one-metal circuits in the many experiments Volta repeated and invented. He was forced to the

conclusion that Galvani had not observed a vital force. Frogs legs just served as sensitive indicators of potential differences arising between different metals.

The scientific controversy that ensued was sharp and sometimes bitter, with shrewd arguments and clarifying experiments on both sides. There were people who could be convinced with the aid of rational arguments, and others who felt that animal electricity and magnetism worked miracles. Finally the palm of the victor was conceded to Volta. He built the first galvanic batteries—artificial electric organs as he tagged them—by piling disks of alternating zinc and copper, or zinc and silver separated by acidly moistened cardboard. When he demonstrated his soon famous pile to Napoleon in Paris, Volta covered it with a skin in mock homage of its predecessor, the electric eel. The point Volta had mightily brought home was that no life was necessary to produce what we now call a galvanic current. He indeed brought critical interest in bioelectric events to a temporary standstill.

If Mesmer was half a world wide of the mark, like Columbus, Parisian physicians understood that what he had truly demonstrated was “that man can act upon man, at all times and almost at will, by striking his imagination,” as some of them reported in 1784. Galvani did not understand the na-

ture of his trail-blasting discovery and Volta, founder of a new technology, worked with blinders. But they grappled with immensely difficult problems. Only, by rejecting what could not be understood, Volta made electricity a practical and measurable power.

A problem and a technique survived. Half a century after the clash between Galvani and Volta over animal electricity scientists had still to explain how muscular contraction was brought about and they had the frog's nerve-muscle preparation to work with. When sensitive galvanometers were developed, the action current of nerve was demonstrated in the middle of the nineteenth century—a slow and undramatic struggle to understand the origin and possible functions of electrical activity in muscle and nerve. In some laboratories remarkable firsts were recorded, as when the bioelectric currents of heart action were demonstrated with the aid of a heart-muscle preparation in 1856. None of us would greatly appreciate having his heart laid bare and tickled with a dead frog; it was only when Willem Einthoven constructed his string galvanometer in 1893 that the registration of the action currents of the heart became a practical proposition. The study of brain potentials in man also had its nineteenth-century forerunners, but useful results were first published in 1929, when Hans Berger re-

vealed long and careful research on brain waves recorded through the unopened human skull.

The long trail, from conspicuous bioelectric events to subtle changes in the brain studying them, was marked with refined instrumentation. The gold leaf electroscope, the moving coil galvanometer, the capillary electrometer, the thermionic vacuum tube amplifier were some of these milestones. So a partial understanding of bioelectric processes was reached. The technical problem had to do with the minute potential differences a working muscle generates—they amount to a few millivolts, while the resistance of the tissue is of the order of thousands of ohms. Thus only about a microampere is available to move a galvanometer, as the current lasts a hundredth of a second the recording system must not weigh too much.

Now faint and brief signals from muscle and nerve, heart and brain can be registered with a remarkable wealth of details. But what is known about the origin of bioelectric potential differences? Are they really manifestations of a vital force more subtle, yet, than the cosmic influx surmised by eighteenth-century believers in animal electricity and magnetism?

No, such potential differences result from ionization processes resembling those occurring in a cell of a man-made battery. A living cell of any kind has a series of jobs

to do, many of them immensely complicated. Many of these chemical tasks are carried out inside the cell membrane, which lets through some substances and keeps others out. With the aid of electron microscopy and advanced chemical methods we now begin to understand that the cell membrane has indeed an elaborate structure and functions quite on its own. Let us then remember that living cells are surrounded by and interact with watery solutions. We can then think of a typical cell as coated with charged molecules, ions, which add up to a potential held positive to the small molecules inside the cell. To follow these events into their details is a bit tricky and there are many specialized cells deviating from the activity of the model cell, but the origin of bioelectricity is no longer a mystery.

Potential differences are present in and around all cells because of their conditions of life and work. Our ideal cell has an inside about 10 mV negative to its outside. Compared to the voltage you can buy for a dime or two this is really not impressive. Across the membrane of a heart muscle cell the potential difference averages 85 mV, but the field strength is 85,00 V/cm, or well above two hundred thousand volts per inch!

Let us stop there for a minute and look upon the possible uses of bioelectric forces of that order. As selective forces have worked, in

their own way, with such problems for a few billion years, we could begin with a look at their present results. In every environment we can imagine cells approximately like those we know of, and indeed every selectively permeable membrane will bring potential differences into being. Environmental forces may act upon such systems directly, as when gravity polarizes a part of a plant placed horizontally by changing ion mobilities across cell membranes.

We could use bioelectric currents for several useful purposes, our thinking along these lines would indeed always be directed toward one or the other distinct function. But this is not how selective forces work. Potential differences arise as by-products of jobs done within cells and transports through cell membranes. They are simply there for no purpose. Other forces may modify these random potential differences, still with no benefit to the individual, whether he may be unicellular or multicellular. Whatever directional evolutionary forces we may trace by hindsight, their raw materials are random processes entirely void of meaning from the viewpoint of survival and reproduction.

Then as it may turn up, after a few billion generations of random changes, mutational events bring forth a creature with a still meaningless modification. When a swarm of such organisms, together

with their unaltered sibs and parents enter a new environment, the modified creatures may have a better chance to establish themselves. Under some circumstances polarizability interactions may make cells band together to mutual advantage.

Some of the many gaps in our knowledge about simple life forms has to do with the obvious fact that even unicellular organisms, now available to examination, result from long chains of evolutionary events. We can draw only tentative conclusions about the first organisms to make use of potential differences—in all likelihood originating by refinements of cell membranes actively at work with the selective transport of ions between a potassium-rich cell and its sodium-rich environment. A notable non-user of considerable potential differences is the clam, whose mantle moves considerable quantities of calcium ions toward the shell; and, when oxygen is in short supply, also in the opposite direction with millivoltages as useless by-products.

Somehow forebears of modern fish species came to use low-voltage discharges from primitive electric organs. They could feel disturbances in the fields resulting from this activity and in this way probably got an advantage when trying to escape their enemies and finding their prey in muddled waters. After many generations of trial and error

they developed almost everything except a cathode-ray tube indicator, which they did not need as their lateral line organ proved a satisfactory conveyor of information from low voltage pulses.

If you get a blow to your unprotected eye, you are likely to perceive a visual sensation and you have acquired some crude information. There will be little incentive to develop and refine the eye as a mechanoreceptor, though the visual sensation derived from the inadequate, mechanical, stimulus undoubtedly lends a rather novel touch to the direct contact with the environment. But early fish developed and refined a mechanoreceptor, tuned to subsonic vibrations, to receive electric pulses carrying information coded by number of discharges or by graded probability of receiving a response.

This is true for the limited number of fish species that developed electric organs. Under normal conditions the ability to discharge and register electric pulses was of no advantage to the forebears of modern fishes—under some circumstances it might, like the involuntary weather prognostic ability of people with muscle and joint disorders today, have been a nuisance. Electric fishes seem not to be overly popular among their colleagues.

That is because they send those tickling pulses; what they receive is their own business. But this re-

ceiver is a minor miracle, made up by mutations improving a bit here, destroying a few billion spawns there, trying again until the electroreceptors of specialized lateral line organs of extant electric fishes are one hundred fifty times as sensitive to millisecond electric pulses as the ordinary lateral line organ they departed from.

Sure enough, by the cruel economy of evolution it was worth while developing emitter organs parallel to receivers, different species of electric fishes use widely different discharge rates, up to a thousand pulses per second. Some fishes operating with low-rate discharges count the number of impulses returned for each set of impulses transmitted, the relation being influenced by things near the fish. Fish species using high emitter rates make a stochastic analysis of responses, the latter being influenced by objects of interest to the fish so that the probability of a registered signal is diminished proportionally to the disturbance in the electric field. Of course no busy fish can be troubled with mental computation of this rather formidable kind, the analysis is made for him by the arrangement of differentially sensitive nerve fibers. It seems likely that some gossip is exchanged on a few fishy citizen band channels, this is still within the range of useful evolutionary gains.

What about the electric athletes, the electric ray and catfish, the seven hundred volt electric eel? What delicacy is required of both Mr. and Mrs. Eel not to turn their union into a shocking disaster? Apparently the development of electric organs in different fish families point to a need arising in similar surroundings. Electric organs for navigation and communication can be put to good use. As a rule they come from modified skeletal muscle, but the Caribbean stargazer has sacrificed ocular muscles. The knifefish probably tried muscle, but finally adapted nerve tissue to emit its millisecond pulses and the electric catfish has draped herself in an electric organ consisting of converted skin glands. Various means have been tried to attain the same worthwhile end. In a few instances development went a long step further and gave the fish a powerful and rather unique weapon. Why unique?

Forces of evolution now and then bring forth successful structures which they then carry too far. A well-known case in point was the saber-toothed tiger, a most imposing beast with the upper canines developed into formidable piercing weapons which could be used only at the price of a drastic remodeling of the jaws. Old saber-tooth became rather specialized and is no longer among us.

It is rather obvious that the bioelectric giants represent a blind

alley of evolution. The extreme forms become marvelously adapted to one prey, one environment, at the price of versatility and chance of survival in a changing surrounding. It is fine to be armored in a hostile world and defensive armor has been widely tried throughout the animal kingdom. A crowning glory of this development was represented by the glyptodonts, with a rigid backplate absorbing a number of vertebrae, a bony helmet and an armored tail. Nobody could be better protected, or more extinct.

Like the armor had the glyptodont—rather than the other way round—the electric organ has the eel. With its Atlantic namesake the electric eel has little more than its elongated form in common. Living in South American brooks with warm and muddy water the electric eel can reach a length well above two yards, weighing forty pounds. Its electric organ occupies four fifths of the length of the animal, some six thousand electroplaques connected in series and a great number of such piles paralleled so that discharges of 1,000 watts can be delivered. An electroplaque has two opposed membranes, developing inside-negative potentials at rest. During a response one of the membranes receives a nerve impulse and, as a rule, becomes depolarized. In the eel it then generates an inside-positive charge. With thousands of such electroplaques in

series, and scores of these live batteries paralleled, the electric eel can deliver a discharge strong enough to stun a man or kill a horse.

As a rule there is no need for such exertions, the eel lives a sluggish life resting in the bottom mud of its brook, electrocuting unsuspecting prey and increasing its girth to that of a man's thigh. Quite a lot of power for that sort of life.

But when another electric eel appears some remarkable activity is released. The head end of the fish being positive, it contacts the tail end of its new acquaintance and they short-circuit each other under violent convulsions until one—or both of them—is slain. It should be admitted that such behavior has been observed only with captive eels, and it is well known that captivity changes the behavior of animals, sometimes to almost human stupidity. But one has every right to suspect that the enormously overdimensioned power resources are deleterious on more than one count.

It seems difficult to avoid the conclusion that the power to release external discharges is of limited use on this planet and has almost always been bought at too high a price. Electrogenesis is everywhere. As far as we know only fishes have developed bioelectric potentials for orientation, communication and sometimes defense

and offense. The lord of creation cannot, without artifice, produce voltage enough to stun a flea.

But human, fish and pea electrogenesis is just a change in membrane potential. This in turn depends upon the selective, and changeable, permeability of membranes which, either fulfill inconspicuous purposes, or, in human beings as well as in electric organs of fishes, respond to nerve impulses with dramatic changes in potential. In the latter instances there is an activation of sodium ions resulting in depolarization, that is a decrease in the inside-negative potential, which then for a millisecond goes one step further to inside-positivity.

When a muscle is excited, the point stimulated becomes negative and then a wave of negativity passes down the muscle, preceding the wave of contraction. With refined instrumentation it has been possible to register action potentials of working muscle in non-electric fishes in the water at some distance. It has been suggested that this is how fish electricity took its origin. Of more immediate interest to most of us is the standard method to register and interpret the composite excitation wave from the human heart, the electrocardiogram.

In a chick embryo a fairly final and recognizable, and almost human, electrocardiogram develops through thirty-six to seventy-two hours of incubation. While skeletal

muscles are excited via their motor nerves, the heart muscle can generate its own excitation. Normally this automatism originates in specific neuromuscular tissue; one series of important observations that can be made from the electrocardiographic tracings concern the normal or disturbed origin and propagation of excitation through this specialized tissue.

The electrocardiogram tells about this excitation indirectly, via the action potentials of the working heart musculature which are in turn modified by the position of the heart and the recording conditions. Today the electrocardiograph is an important diagnostic tool in heart examination. It belongs to the field of daily confirmed clinical knowledge that the heart has maintained its own source of excitation, delegated it to specialized tissue but kept the reserve ability to establish autonomous excitation should the pacemaker fail.

The evolution of multicellular organisms goes from autonomy toward integration, we regularly use nerve tissue to conduct signals and excite muscle. That a vital and continuously contracting muscular organ should be somewhat exceptional can be understood from the viewpoint of survival. But the effector organs of our body—and in that respect the heart is no exception—receive incredibly nuanced series of impulses via nerve cells and their long processes.

Since Galvani's time the conductive properties of nerve fibers have been studied and, during the second half of the nineteenth century, fairly accurate measurements rated the velocity of the nerve impulse slower than that of sound and faster than fluid movements through a fiber-sized tube. With improved techniques the conduction rate in large motor fibers of mammals was narrowed down to 80 to 100 meters per second. But the nerve impulse was invariably accompanied by an electric change. It was also found that this change was independent of the strength of the stimulus so that the nerve fiber either gives a maximal response, or none at all.

None of those facts was in line with a simple model of electric conduction. It was observed—and with the arrival of the cathode-ray oscillograph such observations were made in detail—that the nerve fiber keeps the impulse at its original strength by actively contributing energy and transmits it in leaps from point to point, much like ignition travels along a train of gunpowder. When the human triceps muscle is set to work, the impulses arriving through a single nerve fiber vary from about five to fifty per second, the higher frequencies releasing the stronger contractions. All these observations are compatible with local circuits in pieces of the motor nerve; the traveling impulse reaches one acti-

vated region after another via such local currents.

There are many modifications of this general pattern. We have, for instance, fibers of the sympathetic nervous system with conduction rates varying well below three meters per second. All the composite electrochemical procedures of nerve conduction serve integration. A big community of cells, tissues and organs has to act as a goal-directed unit, or perish. Nerve signals go to muscles and glands, even the heart with its autonomous excitation system receives accelerating and braking impulses to coordinate its work with other activities in the body. From sense organs of many types activating impulses reach nerve cells via specialized fibers. This level of nervous integration is reached by the electric eel as well as by man.

After attaining some higher integration via relays and transceivers in a simple nervous system, the eel invested in an enormous bioelectric battery and was successful in its tepid mud bath. Our forebears invested in highest level integration. In some situations it was more expedient to use a brain than to have a thick and hairy skin or any other structures that could be used for protection. Slowly the hominid brain grew to become a very big organ.

Its electric manifestations are rather modest when traced with the aid of the electroencephalo-

graph. One finds regularly a conspicuous potential change with a wavelike tracing—the alpha rhythm. Soon after it was first described by Berger its origin in the visual association areas in the posterior part of the brain was demonstrated. Here great numbers of branched cell projections conducting impulses toward the cell body lie parallel to each other. This is essential for the production of a synchronous electric field, potential differences wax and wane in other dendrites, as the afferent cell processes are called, but their anatomical arrangement is too irregular to raise alpha type waves as recorded through scalp and skull.

Other activities in the human brain are registered as delta and theta rhythms, features of normal infancy and childhood, and beta rhythms of somewhat uncertain significance. They all carry some clinical weight.

In epilepsy, overt and latent, in the diagnosis of tumors, localized hemorrhages and other brain lesions electroencephalography is of diagnostic use, on the whole it yields less specific information than the electrocardiogram. There is much emphasis on *specific*; a thirty-minute electroencephalogram gives more information about the human brain than that organ can evaluate or even describe succinctly.

Alpha patterns are about as

characteristic of a person as his fingerprints. The frequency ranges between eight and thirteen cycles per second, rarely extending to six and fifteen c/s. In some families an alpha-free electroencephalogram occurs as a dominantly inherited trait. A normal electroencephalogram may show a variation in amplitude of the alpha tracing from zero to forty or fifty microvolts in relaxed persons. When the eyes are opened, or the subject falls asleep, the alpha rhythm disappears. Full awareness, caused by sensory impressions or mental effort, also tends to suppress the alpha rhythm—as in the case of hypnotic sleep.

Mesmer might have accepted the last observation as a new evidence of animal electricity, possibly with less enthusiasm than that with which his followers embraced electromagnetism as demonstrated by Oersted in 1820. Now the enormous inflow of abstruse information, provided by the electroencephalograph, would lend itself to interpretations resembling the reading of tea leaves. To such divinations we should not liken the observation of sympathy between persons with similar alpha rhythms; hosts of comparable relationships have been noted with scarce confirmation.

What we have *not* is sensory receptors for each other's alpha signals. But, combined with telemetry, light-weight electroencephalo-

graphs may be of use in manned flights to distant planets. The pilot could be slumbering to spare nutritional demands and organ wear, his state of awareness could be checked, perhaps by a sleeping member of a pilot crew reacting to definite changes of the telemetered alpha rhythm. When the pilot had done his stint he could return to hypnotic sleep or light electronarcosis.

Why did evolution fail to supply us with the adjustment necessary to let us perceive each other's brain waves, helping us live together in guilelessness and harmony? There are many answers to that question, not living in a semiconductor medium as fish do, we would have to develop quite a load of gadgetry to attain bioelectric telepathy. Long-term survival has been granted to no species on this planet. The hominids got a wider ecologic versatility than other vertebrates by abstaining from armor and congenital weapons of destruction, developing in their stead higher degrees of signal integration and also superior organs of long-range signal reception. It may be convenient to stay in a tepid and narrow home, heavily weaponed like the electric eel. But such adaptation means sacrifice. The electric eel has eye rudiments lacking retinas; he can use his electric organ to locate his prey and find his direction and he certainly needs them, being stone blind. ■



a tale of the ending

*The question of “replacement”
or “evolution” may be somewhat academic
from an individual viewpoint . . .*

HANK DEMPSEY

Illustrated by Vincent diFate

No more could the Elstaran intermovement be stemmed when IJsselDijk a leader of men funneled sametyped through oneone and fortuneted intramovement canceling all tendencies and Elstaran futures subsumed. End of sentence. End of paragraph. End of chapter. End of book. Type.

Dehan stretched widely as the screen before him darkened and, an instant later, his dictation appeared on it in a solid bank of type. He touched the screen in a few places with a stylus and made corrections, then nodded with satisfaction.

"Print," he said and pushed away from his worktable. He saw that it was nearing 75 on the clock, almost the time he usually went swimming with Sousbois, but he was too tired for that now. The work had been intense and concentrated and he had labored at it steadily without getting enough sleep. He stretched again, yawning as well this time, and went to lie gratefully on the bed.

"Lights off," he said and closed his eyes to the velvety darkness and was asleep.

84 the clock read when he awoke and he knew that Sousbois was long gone, but he still wanted to bathe himself. Quickly stripping off his daily clothes he put on a robe and went to the right-hand Door—the one that, by habit, he always used when going out. As he thought of the sunlight and the

water his fingers automatically tapped out the correct twelve-digit code on the signal plate. The surface of the Door shimmered and he stepped through.

From the cool underground room, buried somewhere inside the solid stone of some planet, he walked out into the burning blue sunshine of the Ytong shore. Gasping in lungfuls of the furnace-like air he trotted quickly across the gold sand to the water's edge where little waves rolled up breaking into hissing bubbles one after the other. Quickly, for he could feel the sweat already dotting his skin, he dropped his robe and kicked off his sandals and fell into the water. It closed a cool embrace about him and he sank, rose, wallowed happily.

With just his head above the water he could see the narrow strand vanishing off into the distance on either hand, and the gray wall of the escarpment rising above it. As always when he looked at that immense barrier of stone he wondered idly what lay beyond it, although this was only a fleeting interest. Someone, here, had told him that there was probably only more stone since the land, like the sea, sported no life forms at all. Below the cliff and close to it were a number of Doors since this was a popular bathing area. People hurried in and out of them and the shallow water was dotted with swimmers for as far as he could

see in both directions. The water was very soothing, fresh and transparent, and he ducked under to cool his head and swam slowly along the featureless bottom. When he surfaced he saw that a man had emerged from the Door he had used and was trotting quickly across the searing beach just as he had done. In a moment the stranger was splashing heavily in the shallows, submerging then surfacing nearby.

"Linkica," the newcomer said when he saw that he was not alone.

"Dehan."

They paddled near each other for a few moments, observing the customary period of silence in case either of them did not wish to converse at this time. They remained close by.

"The sun appears to have moved down towards the water," Dehan said, squinting up at it.

"Yes. It won't be long before we must find another beach until it returns. I worked the figures out from observations once. This planet has a period of rotation of 6,430 time units. The day is 3,215 long. Although it is too cold to swim in the early morning."

"You are a man of science?"

Dehan knew that the other must be of some high standing or he would not have used this Door. The ocean of Ytong was here to be enjoyed by anyone, but Doornum-

bers were exchanged only among people of the same levels of attainment. Somewhere on this beach was a child's Door. Perhaps a madman's Door; he neither knew nor cared.

"I am a phylogeneticist."

Dehan nodded unknowingly and splashed water onto his head. Another long word. Another speciality. There must be thousands, perhaps millions of them. "I am a historicollator."

"How interesting. I have always wanted to meet one."

Dehan closed both his eyes in the expression that meant humorous disbelief. "Can it be true? I have never met anyone other than another historicollator who ever heard of the speciality."

The other man rubbed his hairless scalp, now reddening under the sun, and smiled.

"I can pretend no great breadth of knowledge. I must admit that I searched the word out as a reference. In relation to my own work of course . . ."

At the mention of his work he suffered a natural embarrassment and Dehan sank beneath the water and swam in a circle to lessen it. There are certain things that are never discussed while bathing. "I should like to close my pores," he said upon surfacing again. "And you?"

"A fine suggestion." They waded ashore and quickly put on their robes.

"I have recently visited a frigidarium that is very unusual," Linkica said hopefully, volunteering the information to excise the memory of his recent breach of conduct. He spoke the code number aloud, his fingers unconsciously tapping out the combinations of numerals in the air.

"I do not know it. I will be pleased to follow you."

Happier now Linkica moved quickly to the Door and activated it. Dehan stepped through behind him and his body recoiled as the subzero air and swirling snow struck at him, gasping at the sudden shock. They appeared to be on an icy ridge that fell away into snow-clouded nothingness on both sides. Ahead, barely visible through the pelting flakes, were two other Doors set into the cliff face. Linkica had to shout into Dehan's ear to be heard.

"When it is not snowing one can see very, very far in this direction. Mountains, valleys, snowcaps—terribly impressive."

"I shall . . . remember," Dehan stammered through numb lips.

They shuffled across the slippery ice surface, following the groove worn by other footsteps, sharply aware that only a single waist high bar on either side stood between them and plummeting destruction. Gratefully they passed through the Door and into a robing room and each took a cubicle. Dehan sent his soiled robe through a small Door

back to his own quarters then dried and put on a oneuse lounge suit from the dispenser. His skin tingled and he felt wonderful. That was certainly a fine frigidarium. He would try it again, hopefully on a clear day.

Linkica was waiting for him at a table by the immense window. The light of twin moons flooded the valley outside, filling it with infinite shades of gray and black where hills, jungle and river met and merged. Dehan knew this place, built into a high hillside of some tropical world. They nodded, ordered drinks, then sipped them when they appeared on the table.

"What is your work?" Dehan asked. "Phylogen-something you said."

"Phylogeneticist. I attempt to trace the origin of different species, ancestorship, relationships. Most useful in stockbreeding, food plants, that sort of thing."

Dehan nodded although he had no idea of what the man was talking about. Encouraged, Linkica went on.

"Some time ago I was consulted about a gene-linked human disease. I traced its origin and found the correction that must be made. Because of this I became most interested in mankind, this most unusual of all animals, and I began to trace our history. In some ways, one might say, there is a slight resemblance between my small labors

and your great work. Are you working well of late?"

Dehan nodded and smiled. The man was good-mannered after all. One never discussed one's own work in detail until all present had mentioned theirs.

"I have done with the Elstaran. A tedious task, a portion of history that was singularly dull as human history goes, and entirely too long for its own worth. A dozen suns, twenty or so planets, now thankfully gone by courtesy of a fortuitous supernova. I reduced over nine hundred volumes to a single volume, losing nothing of value in so doing."

"Admirable. How we do need your sort of talent to pare the long ribbon of history to manageable units. We would drown in the superfluous were it not for you. I can state this truthfully for, in my own research, I have realized for the first time the incredible length of the history of our species. Would you say millions of time units?"

"More. More." Dehan spoke the words slowly, with deep feeling.

"That it could be so. I do believe it." Linkica bowed his head beneath the weight of the thought. "A moment for beauty, if you will. Sunrise is near and the sky changes."

They watched silently for a brief time. The sky was lightening with a tropical swiftness. Mist rose from the trees and river and the first

muted pink brought color to the grays, touching the swirls and pools with an invisible brush. It was entrancing and they opened themselves to appreciate it.

"I have uncovered strange, curious, quaint and mystifying facts along this endless trail of progress," Linkica said. "Have you ever considered why we count from a twelve digit base?"

"Mathematically it is the best. There are but eleven digits and the zero to remember. Yet still capable of infinite amplitude. Divisible as well by one, two, three, four and six. A fine base."

"That is all?"

"That is enough."

"Have you never considered that at some time, in the dawn of our race, we must have first started to count and in our simplicity used our fingers as a basic system." He spread his hands on the table and looked at his dozen fingers. "Could that not be possible?"

"Possible. But just a theory. You might just as well say that if we had had five fingers on each hand we would have used ten as a base."

Linkica's face went white in an instant and he lifted his glass and drained it quickly.

"An interesting number. Did you pick it by chance? Or has there been a system of mathematics using base ten?"

"I do not remember. But we can find out easily enough."

Dehan strolled across the room to the computer outlet that graced all public places. He was experienced, greatly experienced, at ruthlessly tracking down the most stubbornly hidden facts and this was simplicity itself in comparison. At all times he knew the right questions to ask. His fingers moved on the control squares constantly, changing the displays at almost the very instant they appeared. Through the local computer to the infinite computer, linked through transmitter connections to all the memory units in the galaxy, to mathematics and history and ever deeper. He returned quickly to the table and sipped his drink.

"An interesting fact discovered. At one time, oh dear dear how long ago, the base of ten was universally used. It was replaced by twelve, undoubtedly because of its superiority. So it appears that the finger theory must be dismissed."

"Not at once. My researches have disclosed that at one time a large proportion of mankind had but ten fingers."

"A coincidence." Dehan did not believe the words even as he spoke them.

"Possibly. But if there is an explanation—what is it? If the two facts are interconnected, the resulting logical equation can be read in one of two ways. When the shift from base ten to base twelve occurred there was a resulting change in the number of fingers."

"Highly improbable," Dehan said.

"I agree. Therefore we must consider the alternative that some great mutation, change or conflict swept the human race. Perhaps there were opposing groups and the twelves won over the tens in a great war. . . ."

"There has never been a war like that. I would know."

"Of course. But it is an interesting problem."

They sat in silence for a while, sipping their drinks and watching daylight come to the valley below them. The morning fogs burned away as the first rays of the great orange sun struck through the mountain crags. There were crude dwellings beside the river and Dehan touched the window controls. Instantly the image expanded, so enlarged they appeared to be right in among the huts. A blue-skinned aborigine waddled through the doorway, yawning long saurian jaws to show impressive rows of pointed teeth. It picked up a stick and dug at some irritation in the deep folds of skin while looking on coldly at the growing activity around.

"Time bound," Linkica said. "We were once that way, too. The ontological evidence is clear."

"I do not know what you are referring to."

"These creatures. Their life cycles are bound to the planetary rotation. They sleep during periods

of darkness and are awake during their day."

"How unnatural."

"Not at all. It is the natural outcome of a planetary existence. It has taken us thousands of generations to outgrow our dependence upon a waking-sleeping cycle, to reach the present point where we sleep for short periods whenever we feel tired."

"I can imagine no other way to sleep. And if this change were made, what possible reason could there be for it?"

"That appears obvious. The Doors. Their introduction must have altered every facet of existence."

Dehan raised his eyebrows. "Then you are not one of those who believe that the Doors have been with us from the dawn of time?"

"A child's myth. The Doors are artifacts that we still build. Though now they are single units, solid block, solid state construction, almost indestructible, they were not always that way. Earlier forms can be found in museums. Have you never wondered why there are always two Doors together, always?"

"I never thought of it."

"There is a reason. An engineer told me. Perfect as the Door mechanism is there can be, once in a very long while, a failure of mechanism. If this happens, the other Door is always standing ready. There are many places

where it would be embarrassing to be without a Door."

"Indeed!" Dehan said and felt cold at the thought, thinking about his room. It was embedded in the solid rock of a world whose name he forgot. He had never been on its surface because it was airless. At one time it had been mined for precious metal and great tunnels were driven through the heart of the stone mountains. When the ore was gone the tunnels had been plugged with molten slag—at intervals. Doors had been left in the boxlike openings to be furnished as private quarters. Very private. Without the Doors they were but bubbles in the rock. It would be a lonely, forgotten death for anyone trapped in one of them.

"Logic forces us to a single conclusion," Linkica said. "There must have been a time, unimaginable as it is to us, when mankind did not possess the Doors."

"It follows then, that you are a monolinearist, not a multifontist?"

"Of course. For one thing it is biologically impossible to have a single species occur in a number of different places and then be able to interbreed. Just as there was a time when we had no Doors, so was there a time when we were confined to one restricted area of space."

"To but a single planet?"

Linkica smiled. "You said it—I did not. It carries the theory almost too far."

"Why? I do not tempt you into rash statements for I am as enthusiastic a monoliner as you are, even though it is an unfashionable attitude to hold these days. I will go even further. I believe we did originate on a single planet at one time. Just as those creatures out there are natives of this world and incapable of leaving."

"You force agreement from me. I admit to physical change, but never considered that cultural change must accompany it. We may have originated from as crude a background as this one. If so—it had to be a single planet."

"I have long thought so, and during my work have traced mankind's movements backwards as far as possible. Always I have found the simpler growing into the complex. My researches have been exhaustive."

Linkica shielded his eyes for a moment in the sign of great appreciation. "Can it be that you have discovered this home world?"

"Perhaps. Though I doubt it. I have traced back all records, the oldest records, to an incredibly ancient world. I do not know if it is *the* planet, only that there are none older."

"I humbly request the code."

"A pleasure to share it." Dehan spoke the digits aloud. "In fact we could go there now and see it."

"You are kind."

"I am pleased to take you. So few show any interest at all."

Dehan led the way through the Door to a crudely furnished room.

"So rarely do people come here that it is sealed for the most part. See my visits on the graph. The first in many thousand units." He examined the controls and nodded with satisfaction. "Air, temperature, all is well."

They passed through a sealing door into a long, corridor-like room. There were viewing ports set into one wall while everywhere else were cabinets and displays.

"Dead now," Linkica said, looking out on the desiccated landscape. A sun, scarcely brighter than the other stars, shone as a cold unblinking disk in the black sky. Air gone, water gone, life gone, bare sand and rock stretched flatly to the horizon. Yet nearby great monoliths, fissured and eroded, still bore witness of having been shaped by some intelligence.

"These cases contain the few identifiable objects found here."

Linkica turned with a high anticipation that faded and died.

"These could be—anything," he said, pointing to the eroded lumps of metal and stone.

"I know. But should we expect more?"

"Of course not."

Linkica looked once more at the mute ageold shapes then out again at the dead plain. He shivered, although the room was warm and comfortable. "I feel the weight of ages here. More time than I can

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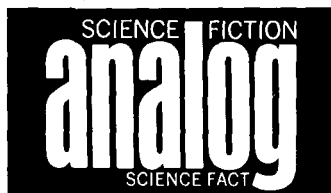
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possibly understand has passed for this world. I see how short my own individual span of existence is and how unimportant."

"I have felt the same thing myself, here, many times. It is said that a man's mind cannot encompass the idea of its own death, but how a species might die. If we had not had the Door we would be here, trapped here, dead here, if this were the only world we had ever known."

"Give thanks it was not. Mankind is universal. We rule everywhere."

"But for how long? Is not one galaxy—in the fullness of time—like one planet? Will it not die? Or could we not be displaced by some other creature? Something stronger, newer, better. I must admit that this is a recurrent nightmare I have. The Doors are everywhere. Might *one* of them not be in the wrong spot? A planet say where this other species waits. To subtly move among us, displace us and end our existence?"

"It is possible," Linkica agreed. "All things are possible in the fullness of eternity. But it would be a painless conquest. We would never know. Why do you point?"

"There. I wished to talk with you first before you saw this last artifact."

The lights grew brighter as they approached and the figure could be plainly seen. Painting or photograph, it lay beneath a thick trans-

parent coating and many details were visible despite its age.

"What is this creature?" Linkica asked. "Very like a man, indeed. But look, it has fur upon its skull as we do not, nor does it have a nictitating membrane in its eyes. The anatomy is wrong, the joints—and look. Five fingers on each hand, ten in all . . ."

He stopped, struck silent by memory, and turned wide-eyed towards Dehan who nodded slowly.

"This is what frightens me. The word inscribed beneath the figure is the name of a leader so great that I have found references to him in a few sources. *Our* sources. Ancient records. It appears then, looking at this man . . ."

"But *we* are men!"

"Are we? We call ourselves men and have mankind's cultural heritage. But is it not possible that—as we theorized earlier—that mankind could be replaced. That we have indeed replaced them."

"Then—who are we?" A shudder passed through him at the thought.

"We? We are mankind now. By cultural inheritance if not by blood line. But that is not what disturbs me. It is a more selfish thought."

For a long moment there was only silence in the lifeless room on a dead world.

"I think always. What thing is waiting out there, that will sometime—perhaps even now—replace us?" ■



Compulsion

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*That plants could produce addictive metabolites was old—
but the Siren pseudotrees had something else going for them.
And Telzey found it was enormously more
than she'd bargained for!*

JAMES H. SCHMITZ

Illustrated by Kelly Freas

I

There'd been a dinner party at the Amberdon town house in Orado City that night. Telzey was home for the weekend but hadn't attended the party. Graduation exams weren't far away, and she'd decided she preferred to get in additional study time. It was mainly a political dinner anyway; she'd been at enough of those.

Most of the guests had left by now. Four of them still sat in the room below her balcony alcove with Gilas and Jessamine, her parents. They'd all strolled in together a while ago for drinks and conversation, not knowing someone was on the balcony. The talk was about Overgovernment business, some of it, from the scraps Telzey absently picked up, fairly top-secret stuff. She wasn't interested until a man named Orsler started sounding off on something about which he was

evidently very much annoyed. It had to do with the activities of a young woman named Argee.

Telzey started listening then because she disliked Orsler. He was an undersecretary in Conservation, head of a subdepartment dealing with uncolonized and unclaimed worlds and the life forms native to them. Telzey had scouted around in his mind on another occasion and discovered that those remote, unsuspecting life forms had a dubious champion in Orsler. He was using his position to help along major exploitation schemes, from which he would benefit substantially in roundabout ways. She'd decided that if nobody had done anything about it by the time the schemes ripened, she would. She gave the Overgovernment a little quiet assistance of that kind now and then. But the time in

question was still several months away.

Meanwhile, anything that vexed Orsler should make enjoyable hearing. So she listened.

The group below evidently was familiar with the subject. There was a treelike creature, recently discovered somewhere, which was dangerous to human beings. Orsler's department had it tentatively classified as "noxious vermin," which meant it could be dealt with in any manner short of complete extermination. Miss Argee, whose first name was Trigger, had learned about this; and though she lacked, as Orsler pointed out bitterly, official status of any kind, she'd succeeded in having the classification changed to "quarantined, pending investigation," which meant Orsler's department could do nothing about the pseudotrees until whatever investigations were involved had been concluded.

"The girl is simply impossible!" Orsler stated. "She doesn't seem to have the slightest understanding of the enormous expense involved in keeping a planet under dependable quarantine—let alone three of them!"

"She's aware of the expense factor," said another guest, whose voice Telzey recognized as that of a Federation admiral who'd attended Amberdon dinners before. "In fact, she spent some time going over it with me. I found she had a

good grasp of logistics. It seems she's served on a Precol world and has been on several long-range expeditions where that knowledge was put to use."

"So she's annoyed you, too!" said Orsler. "If any citizen who happens—"

"I wasn't annoyed," the Federation admiral interrupted quietly. "I rather enjoyed her visit."

There was a pause. Then Orsler said, "It's amazing that such an insignificant matter could have been carried as far as the Hace Committee! But at least that will put a prompt end to Argee's fantastic notions. She's a Siren addict, of course, and should be institutionalized in her own interest."

Federation Councilwoman Jessamine Amberdon, who served on the Hace Ethics Committee, said pleasantly, "I'd prefer to think you're not being vindictive, Orsler."

"I?" Orsler laughed. "Of course not!"

"Then," said Jessamine, "you'll be pleased to know that the Committee is handling this as it handles all matters properly brought before it. It will await the outcome of the current investigations before it forms a conclusion. And you needn't be concerned about Miss Argee's health. We have it on good authority that, while she was at one time seriously addicted to the Sirens, she's now free of such problems. Her present interest in

them, in other words, is not motivated by addiction."

Orsler evidently didn't choose to reply, and the talk turned to other subjects. Regrettably, from Telzey's point of view. Orsler had found no support, and had been well squelched by Jessamine, which she liked. But now she was intrigued. Treelike Sirens which addicted people and rated a hearing in the Ethics Committee were something new.

She could ask Jessamine about it later, but she'd have to admit to eavesdropping then, which her mother would consider not quite the right thing to have done. Besides, one of the minds down there could tell her. And having been in Orsler's mind before, reentry would be a simple matter—

Unless there happened to be a Guardian Angel around. Frequently enough, they hovered about people in upper government levels for one reason or another. She'd picked up no trace of their presence tonight, but they were rather good at remaining unnoticed.

Well, she'd find out. She dropped an entry probe casually toward Orsler.

And right enough:

"Telzey Amberdon, you stop that!"

It was a brisk, prim thought form, carrying distinct overtones of the personality producing it. She knew this particular Guardian An-

gel, or Psychology Service psi operator, who probably was in a parked aircar within a block or two of the Amberdon house—a hard-working, no-nonsense little man with whom she'd skirmished before. He was no match for her; but he could get assistance in a hurry. She didn't complete the probe.

"Why?" she asked innocently. "You're not interested in Orsler, are you?"

"He's precisely the one in whom I'm interested!"

"You surprise me," said Telzey. "Orsler's a perfect creep."

"I won't argue with that description of him. But it's beside the point."

"A little mental overhauling wouldn't hurt him," Telzey pointed out. "He's no asset to the Federation as he is."

"Undersecretary Orsler," the Angel told her sternly, "is not to be tampered with! He has a function to perform of which he isn't aware. What happens after he's performed it is another matter—but certainly no business of yours."

So they knew of Orsler's planetary exploitation plans and would handle it in their way. Good!

"All right," Telzey said amiably. "I have no intention of tampering with him, actually. I only wanted to find out what he knows about those Sirens they were talking about."

A pause. "Information about the pseudotrees is classified," said the Angel's voice. "But I suppose that technicality means little to you."

"Very little," Telzey agreed.

"Then I suggest that your mother knows more about the subject than anyone else in the room."

Telzey shrugged mentally. "I don't snoop in Jessamine's mind. You know that."

A longer pause. "You're really interested only in the Sirens?" asked the Angel.

"And Trigger Argee."

"Very well. I can get you a report on the former."

"How soon?"

"It will be in your telewriter by the time you reach your room. As for Miss Argee, we might have a file on her, but you can hardly expect us to violate her privacy to satisfy your curiosity."

"I wouldn't ask you to violate anyone's privacy," Telzey said. "All I'd like is her background, what kind of person she is—the general sort of thing I could get from a good detective agency tomorrow."

"I'll have a scan extract made of her file," the Angel's voice told her. "You'll receive it in a few minutes."

The blue reception button on the ComWeb's telewriting attachment was glowing when Telzey came into her room. She closed the door, took the report tape on the

Sirens from the reception slot, put the study reader she'd brought with her on a table, locked in the tape and sat down. The report began flowing up over the reading screen at her normal scanning rate.

An exploration group had discovered the Sirens on a terratype world previously covered only sketchily by mapping teams. They were the planet's principal life form, blanketing the land masses in giant forests. The explorers soon discovered that a kind of euphoria, a pleasurable feeling of being drawn to them, was experienced by anyone coming within a few hundred yards of the pseudotrees. So they began referring to this life form as the Sirens.

It was a hospitable life form. Every other creature found on the planet turned out to be a Siren parasite, living on the seemingly endless variety of edible items they produced. Tests disclosed surprisingly that many, perhaps all, of those items also satisfied human nutritional needs, and that most were pleasantly flavored. It wasn't long before half the expedition personnel were plucking their meals from the Sirens whenever they felt like it, in preference to resorting to their Hub supplies.

The notion of establishing this interesting and useful find in the Federation naturally arose. However, some caution seemed indicated; there was reason to believe the Sirens had a potentially very

high propagation rate, perhaps enough to make them a problem on civilized worlds. Two expedition ships presently carried Siren saplings and seedlings, along with other specimens from the planet, back to the Hub for further research.

At that time, several disconcerting discoveries were made almost simultaneously. A number of expedition members deserted together, leaving a message explaining that they intended to spend the rest of their lives among the Sirens, and it was realized belatedly that all who had been in contact with the Sirens for any length of time had developed varying degrees of emotional addiction to them. Then the ruins of a human colony, judged to be eight hundred years old, were unearthed; and the question of what had happened to the colonists on the Siren world was solved by the dissection of one of the parasitical specimens brought back to the Federation. Much of its internal structure still recognizably followed the human pattern. Without such evidence, no one could have suspected that this slow-moving, blind climber and crawler had branched away from the human species less than a thousand years ago.

It appeared that the Sirens induced other creatures to become dependent on them, and that even a highly evolved species then degenerated very rapidly to the point

of becoming a true parasite, unable to survive away from its hosts. A space scan disclosed that two other worlds in that stellar area were also covered with Siren forests. On those worlds, too, there seemed to be no creatures left which hadn't become Siren parasites, and the indication was that their original human discoverers had introduced them to two associated colonies. In effect, all three human groups then had been wiped out. Their modified descendants could no longer be regarded as human in any significant sense.

The discovery of the Sirens wasn't publicized. General curiosity might be dangerous; there was a chance that Sirens could be transplanted to a civilization which wouldn't recognize their strange qualities until it was virtually destroyed. Various Overgovernment departments began making preparations for the sterilization of the three worlds. It seemed the only reasonable solution to the problem.

But there was somebody who wouldn't accept that.

The report didn't give the name of the former expedition member who argued that it wasn't the Sirens but their dangerous potential which should be eliminated, that they had intelligence, though it was intelligence so different from humanity's that it had been impossible for them to recognize the harm they did other creatures.

That couldn't be proved, of course. Not on the basis of what was generally known.

But neither could it be disproved—and the Overgovernment had been systematically alerted to the fact all along the line. A stop order went out on the preparation of sterilization measures . . .

Telzey's lips quirked approvingly. Unless it could be shown that there was no alternative, or that a present emergency existed, the extermination or near-extermination of a species, let alone that of a species possessing sentient intelligence, was inexcusable under Federation law. The former expedition member had made a very good move. Investigations were now being conducted at various levels, though progress was hampered by the fact that investigators, unless given special protection, also became liable to Siren addiction.

"At present," the report concluded, "no sufficiently definite results appear to have been obtained."

The telewriting receiver had emitted a single bright *ping*-note a minute or two earlier, and the blue button was glowing again. Telzey dropped the tape on the Sirens into the room's disposal, and locked the tape on the determined former expedition member into the reader.

This extract was considerably shorter. Trigger Argee was twenty-six, had a high I. Q., had been

trained in communications, administration, basic science, survival techniques and unarmed combat at the Colonial School on Maccaddon, had served in Precol on the world of Manon, and been employed in an administrative capacity on three U-League space expeditions. She was twice a pistol medalist, responsible, honest, had a good credit rating, and maintained a fashionable on-and-off marriage with an Intelligence colonel. She'd been recently issued a temporary Class Four Clearance because of volunteer activities in connection with a classified Overgovernment project. Previous activities, not detailed in the extract, qualified her for a Class One Clearance if needed.

The last was intriguing. Of the high-ranking people in the room below the balcony alcove, probably only Jessamine Amberdon held the Overgovernment's Class One Clearance. It might explain why Undersecretary Orsler and others had been unable to check the Siren crusade. Telzey dropped the extract into the disposal, made a mental note to check occasionally on the progress being made in the project.

When she got back down to the alcove, they were still talking in the room below, but it appeared that Orsler and his Guardian Angel had made their departure, the Angel presumably having provided Orsler with an unconscious motivation to leave. He believed in taking no chances with his charges.

Telzey grinned briefly, quietly gathered up her study materials and carried them back to her room.

II

The Regional Headquarters of the Psychology Service on Farnhart was housed in a tall structure of translucent green, towering in wilderness isolation above a northern ocean arm. Pilch stood in gray Service uniform at a window of the office on the eightieth level which she'd taken over from the Regional Director that morning, gazing at the storm front moving in from the east. She was a slender woman, rather tall, with sable hair and ivory features, whose gray eyes had looked appraisingly on many worlds and their affairs.

"Trigger Argee," announced the communicator on the Director's desk behind her, "is on her way up here."

Pilch said, "Show her through to the office when she arrives." She went to the desk, placed a report file on it, turned to the side of the room where a large box stood on a table. Pilch touched one of the controls on the box. Its front wall became transparent. The lit interior contained what appeared to be a miniature tree planted in a layer of pebbly brown material. It stood about fifteen inches high, had a curving trunk and three short branches with a velvety appearance

to them, and a dozen or so relatively large leaves among which nestled two white flower cups. It was an exquisitely designed thing, and someone not knowing better might have believed it to be a talented artist's creation. But it was alive; it was a Siren. Three months before, it had been a seedling. Left to itself, it would have stood three times Pilch's height by now. But its growth had been restrained, limiting it still to a seedling's proportions.

The office door dilated, and a mahogany-maned young woman in a green and gold business suit came in. She smiled at Pilch.

"Glad to see you!" she said. "I didn't know you were on Farnhart until I got your message."

Pilch said, "I arrived yesterday to handle some Service business. I'll leave again tonight. Meanwhile, here's your specimen, and copies of our investigators' reports."

"I'm sorry no one found anything positive," Trigger said. "I was beginning to feel we were on the right track finally."

"We won't assume it's the wrong track," said Pilch. "The results aren't encouraging, but what they amount to is that the xenotelepaths we had available weren't able to solve the problem. Various non-human xenos were called in to help and did no better. Neither, I'll admit, did I, when I was checking out the reports on the way here."

Trigger moistened her lips. "What is the problem?"

"Part of it," Pilch said, "is the fact that the investigations produced no indication of sentiment intelligence. The Sirens' activities appear to be directed by complex instinctual drives. And aside from that, your specimen is a powerhouse of psi. The euphoria it broadcasts is a minor manifestation, and we can assume that its ability to mutate other organisms is psi based. But it remains an assumption. We haven't learned enough about it. Most of the xenos were unable to make out the psi patterns. They're very pronounced ones and highly charged, but oddly difficult to locate. Those who did recognize them and attempted to probe them experienced severe reactions. A few got into more serious trouble and had to be helped."

"What kind of trouble?" Trigger asked uneasily.

"Assorted mental disturbances. They've been straightened out again."

"Our friend here did all that?"

"Why not? It may be as formidable as any adult Siren in that respect. The euphoric effect it produces certainly is as definite as that of the older specimens."

"Yes, that's true." Trigger looked at the box. "You're keeping a permanent psi block around it?"

"Yes. It can be turned off when contact is wanted."

Trigger was silent a moment, watching the Siren. She shook her head then. "I still don't believe they don't have intelligence!"

Pilch shrugged. "I won't say you're wrong. But if you're right, it doesn't necessarily improve the situation. The psi qualities that were tapped appear to be those of a mechanism—a powerful mechanism normally inaccessible to alien psi contact. When contact is made, there is instant and violent reaction. If this is a reasoned response, the Siren seems to be an entity which regards any psi mind not of its own species as an enemy. There's no hesitation, no attempt to evaluate the contact."

"It may be a defensive reaction."

"True," Pilch said. "But it must be considered in conjunction with what else we know. The three Siren worlds appear sufficient evidence that the goal of the species is to take over all available space for itself. It has high mobility as a species, and evidently can cover any territory that becomes available to it with startling speed. As it spreads, all other life forms present are converted to harmless parasites. This again, whether it's an instinctive process or a deliberate one, suggests the Siren is a being which tolerates only its own kind. Its apparent hospitality is a trap. It isn't a predator; it makes no detectable use of other forms of life. But it interrupts their evolutionary

development and, in effect, eliminates them from the environment."

Trigger nodded slowly. "It's not a good picture."

"It's a damning picture," said Pilch. "Translated to human terms, this is, by every evaluation, a totally selfish, paranoid, treacherous, indiscriminately destructive species, a deadly danger to any other species it encounters. What real argument for its preservation can be made?"

Trigger gave her a brief smile.

"I'll argue that the picture is wrong!" she said. "Or, anyway, it's incomplete. If the Sirens, or their instincts, simply wanted to eliminate other creatures, there'd be no need for that very complicated process of turning them into parasites. One good chromosomal error for each new species they came across, and there'd be no next generation of that species around to annoy them!"

"Yes," Pilch said. "That's one reason, perhaps the only substantial reason so far, for not being too hasty about the Sirens." She paused. "Have you been getting any encouraging reports on the physical side of the investigation?"

Trigger shook her head. "Not recently. The fact is, the labs are licked—though some of them won't admit it yet."

"What we've learned about the specimen," said Pilch, "indicates they'll be forced to admit it eventually. If it weren't basically a psi

problem, all the talent you've rounded up and put to work should have defanged the Sirens before this. The problem presumably will have to be solved on the psi level, if it's to be solved at all."

"It does seem so," Trigger agreed. She hesitated. "I'm trying to keep the labs plugging away a while longer mainly to gain time. If it's official that they've given up, the push to sterilize the Siren worlds will start again."

"It may be necessary to resort to that eventually," said Pilch. "They can't be left at large as they are. Even if the closest watch is maintained on those three worlds, something might go wrong."

"Yes, I know. It still would be a mistake though," Trigger said. "Exterminating them might seem necessary because we hadn't been able to think of a good solution. But it would be a mistake, and wrong."

"You're convinced of it?"

"I am."

"Why?"

Trigger shook her head. "I don't know. Since I became unaddicted, I haven't even liked the Sirens much. It's not that I dislike them—I simply feel they're completely alien to me."

"How do you react now to the euphoria effect?" Pilch asked.

Trigger shrugged.

"It's an agreeable feeling. But I know it's an effect, and that makes it an agreeable feeling I'd sooner

not have. It doesn't exactly bother me, but I certainly don't miss it when it's not there."

Pilch nodded. "There've been a few other occasions," she remarked, "when you've acted in a way that might have appeared dead wrong to any other rational human being. It turned out you were right."

"I know. You think I'm right about this?"

"I'm not saying that. But I feel your conviction is another reason for not coming to overly hurried conclusions about the Sirens." Pilch indicated the container. "What plans do you have for the specimen now?"

"I'm beginning to run a little short of plans," Trigger admitted. "But I'll try the Old Galactics next. They're a kind of psi creature themselves, and they're good at working with living things. So I'll take the specimen to them."

Pilch considered. "Not a bad idea. They're still on Maccadon?"

"Very probably. They were there six months ago, the last time I visited Mantelish's garden. They weren't planning to move."

"When are you leaving?"

"Next ship out. Some time this afternoon."

Pilch nodded. "I'll be passing by Maccadon four days from now. I'll drop in then and contact you. And don't look so glum. We're not at the end of our rope. If it seems the Old Galactics can't handle the Si-

rens, I'll still have a few suggestions to make."

"Very glad to hear it!"

"And while we're on Maccadon," Pilch continued, "I'll have you equipped with a mind shield."

"A mind shield?" Trigger looked dubious. "I know they're all using them in the labs, but . . . well, I had to wear one for a while last year. I didn't like it much."

"This will be a special design," Pilch told her. "It won't inconvenience you. If you're going to start escorting the specimen around again, you should have a good solid shield, just in case. We know that now."

III

In the rolling green highlands south of the city of Ceyce on Maccadon, Trigger's friend Professor Mantelish maintained a private botanical garden. It was his favorite retreat when he wanted to relax, though he didn't manage to get there often. Trigger herself would drop in now and then and stay for a week or two, sleeping in the room reserved for her use in the big white house which stood near the center of the garden.

The garden was where the Old Galactics lived. Only Trigger and Pilch knew they were there. Mantelish might have suspected it, though he'd never said so. Very few other people knew even of their existence. They'd had a great

culture once, but it had been destroyed in a vast war which was fought and over with in the Milky Way before men learned how to dig mammoth pits. Not many Old Galactics survived that period, and they'd been widely scattered and out of contact, so that they had only recently begun to gather again. The garden appeared to be their reassembly area, and a whole little colony of them was there by now, arriving by mostly mysterious methods from various regions of the galaxy. That any at all of the fierce race which had attacked their culture still existed was improbable. The Old Galactics had formidable powers; and when they finally decided something needed to be eliminated, they were very thorough and patient about it.

Communication between them and humans was at best a laborious process. Trigger had done them a service some time before, and had learned how to conduct a conversation with Old Galactics on that occasion. They seemed to live on a different time scale. When you wanted to talk to them, you didn't try to hurry it.

So when she arrived at the garden with the Siren, she went first to her room in the house, steered the container on its gravity float to a table, settled it down on the tabletop and switched off the float. Then she unpacked, taking her time and putting everything away, arranging books she'd brought

along on the shelves beside others she'd left here on her last visit. Afterwards, Mantelish's housekeeper brought a lunch to the room, and Trigger ate that slowly and thoughtfully. Finally she selected a book and sat down with it.

All this time, she'd been letting the Old Galactic with whom she was best acquainted know she was here, and that she had a problem. She didn't push it, but simply brought the idea up now and then and let it, so to speak, drift around for a moment. Shortly after she'd settled down with the book, she got an acknowledgment.

The form it took was the image of one of the big trees in the garden, which came floating up in her mind. It wasn't the tree the Old Galactic had been occupying when she was here last, but they changed quarters now and then. She sent him a greeting, slipped the book into her jacket pocket, and left the room, towing the Siren container behind her.

By then, it was well into the spring afternoon. Three Tainequa gardeners were working near the great tree as she approached, small brown-skinned men, members of a little clan Mantelish had coaxed into leaving its terraced valley on Tainequa and settling on Macca-don to look after his collection. Trigger smiled and said hello to them; and they smiled back and then stood watching thoughtfully as she went on toward the tree, se-

lected a place where she could sit comfortably among its roots, grounded the container, and took the book from her pocket.

When she looked up, the three Tainequas were walking quietly off along the path she'd come, carrying their tools, and in a moment they'd disappeared behind some shrubbery. Trigger wasn't surprised. The Tainequa valley people were marvelously skilled and versatile gardeners—entirely too good at their craft, in fact, not to understand very well that Mantelish's botanical specimens flourished to an extent even their talented efforts didn't begin to explain. And while they knew nothing about Old Galactics, they did believe in spirits, good and evil.

If they'd thought the local spirits were evil, the outrageous salary Mantelish was obliged to pay the clan couldn't have kept it on Maccadon another hour. Benevolent spirits, however, are also best treated with respect by mortal man. The Tainequas worked diligently elsewhere in the garden, but they kept their distance from the great trees which obviously needed no care from them anyway. And when Trigger sat familiarly down beside one, any Tainequa in sight went elsewhere. She wasn't quite sure what they thought her relationship with the spirits was, but she knew they were in some awe of her.

Under the circumstances, that

was convenient. She didn't want anyone around to distract her. Actually, the Old Galactics did almost all the real work of carrying on the conversation, but she made it easier by remaining simultaneously relaxed and attentive and not letting her thoughts stray. So while she was looking down at the book on her knees, she wasn't reading. Her eyes, unfocused, blinked occasionally at nothing. She'd been invited to come; she'd come, and was waiting.

She waited, without impatience. Until presently:

Describe the problem.

She didn't sense it as words but as meaning, and sensed at the same time that there was more than one of them nearby, her old acquaintance among them. They liked the great trees of the garden as dwellings, their substance dispersed through the substance of the tree, flowing slowly through it like sap. They had their own natural solid shape when they chose to have it. And sometimes they took on other shapes for various purposes. Now a number of them had gathered near the base of the tree, still out of sight within it, to hear what she wanted.

She began thinking about the Sirens. The small one here in its container, and its giant relatives, mysterious and beautiful organisms, spread about three worlds in towering forests. She thought of how

humans had encountered the Sirens and discovered how dangerous they were to other life, so dangerous that their complete extermination was beginning to look like the only logical way of dealing with them, and of her feeling that this would be totally wrong even if it seemed in the end to be inevitable. She didn't try to organize her thinking too much; what would get through to the Old Galactics were general impressions. They'd form their own concepts from that.

What do you want done?

She thought of the possibility that the Sirens had intelligence, and of reaching that intelligence and coming to an understanding with them so they would stop being uselessly destructive. Or, if they were creatures capable only of acting out of instinct, then ways might be found to modify them until they were no longer dangerous. The Old Galactics were great scientists in their own manner, which wasn't too similar to the human manner; and perhaps, Trigger's thoughts suggested, they would be able to succeed with the Sirens where humans so far had failed. She thought about the difficulties Pilch's xenotelepaths had encountered in trying to contact her specimen on the mental level, and of the fact that most humans had to be protected by psi blocks or mind shields against Siren euphoria.

There was stillness for a while then. She knew she'd presented the matter sufficiently, so she simply waited again. About an hour and a half had passed since she first sat down under the tree, which meant that from the Old Galactics' point of view they'd been having a very brisk conversational exchange.

By and by, something was told her.

Trigger nodded. "All right," she said aloud. She switched on the container's gravity float, moved it so that it stood next to the base of the big tree, and there grounded it again. Then she shut off the psi block, turned the front side transparent, opened the top, and sat down on a root nearby from where she could watch the Siren.

The euphoric effect became noticeable in a few seconds, strengthened gradually, then remained at the same level. It was always pleasurable, though everybody seemed to experience it in an individual manner. For Trigger it usually had been a light, agreeable feeling, which seemed a perfectly natural way to feel when she had it—a sense of well-being and contentment, an awareness that it came from being around Sirens, and a corresponding feeling of liking for them. In the course of time, that had been quite enough to produce emotional addiction in her; and other people had been much more directly and strongly

affected. "That's it," she said now, for the Old Galactics' benefit.

There was no response from them; and time passed again, perhaps fifteen or twenty minutes. Then something began to emerge from the bark of the big tree above the container.

Trigger watched it. In its solid form, an Old Galactic looked something like a discolored sausage; and this was what now appeared to be moving out from the interior of the tree. It was a very slow process. It took a minute or two before Trigger could make out that this wasn't her acquaintance, who was sizable for his kind, but a much smaller Old Galactic, probably not weighing more than half a pound. It got clear of the tree at last, moved down a few inches until it was level with the top of the container, curved over to it, and started gliding down inside. Eventually then the sausage shape reached the base of the Siren, touched it, began melting into it.

Something else was said to Trigger. She hesitated questioningly a moment, then placed her wrist against the side of the root on which she was sitting and left it there. A minute or two afterwards, a coolness touched the inside of her wrist. She couldn't see what caused it, but she knew. She also knew from experience that it harmed a human body no more than it harmed a tree to have an Old Galactic's substance dispersed

through it; they were unnoticeable, and if there was anything wrong with the body when they entered, they would take care of it before they left, precisely as they tended to the botanical specimens in Mantelish's garden.

In this case, they weren't concerned about Trigger's health, which was excellent. But they evidently felt, as had Pilch, that if she was going to be involved with a Siren, she should have the protection of a mind shield; and an Old Galactic specialist was now to begin providing her with their equivalent of one. He should be finished with the job in a few days. Trigger asked some questions about it, was given explanations, and presently agreed then to let the specialist go ahead.

The rest of the afternoon passed uneventfully, as far as she was concerned. They'd told her after a while to restore the psi block and close the container. She was glad to do it. It was unlikely that a Tainequa would approach this section of the garden again today and get within range of the euphoria effect, but one never knew just what might happen if an area was exposed to the effect for any extended period of time. After that, the Old Galactics ignored her. She read a while, stretched out in the grass near the tree for a nap, read some more. Eventually it was getting near evening, and there

still had been no indication that the Old Galactics intended to interrupt whatever they were doing. Trigger went to the garden house, came back with her supper, a sleeping bag, and a few more books. She ate, read until dark, got into the bag, and fell asleep.

She dreamed presently that she was back in a great Siren forest on a faraway world, swimming in the euphoria experience, but now frightened by it because she was aware she was becoming addicted. She made a violent effort to escape, and the effort brought her awake.

She knew where she was immediately then. A cloud bank covered the sky, with the starblaze gleaming through here and there; the garden lay quiet and shadowy around her. But the sense of Siren euphoria hadn't faded with the dream.

Trigger turned over, slipped partly out of the sleeping bag, and sat up. She couldn't make out the Siren container too well in the shade of the great tree, but she could see that it had been opened; and the psi block obviously was switched off. She had a moment of alarm. Then Old Galactic thought brushed slowly past her.

They weren't addressing her, and she couldn't make out any meaning. But she saw now that several dark sausage shapes of varying sizes were on the container. A vague thought pulse touched her mind again. It was ridiculous to

think of Old Galactics becoming excited about anything; but Trigger had the impression that the little group on the container was as close to excitement as it could get. One of them evidently touched the psi block control then because the euphoria effect went out.

She sat there a while longer watching them and wondering what they were doing; but nothing much happened and she had no more thought impressions. Presently they began to move back to the big tree and into it. The last one shifted the control that closed the container before turning to follow his companions. Trigger got down into the bag again and went back to sleep. When she woke up next, it was cool dawn in the garden, everything looking pale and hazy. And the Old Galactics were speaking to her.

She gathered that the matter looked quite favorable, but that they couldn't give her definite information yet. One of them was still inside the Siren, analyzing it. She was to take the container back to her room now, and return with it in the evening. Then they would be able to tell her more.

IV

"Well?" Pilch inquired, when they met two days later in Ceyce.

"They can do it," Trigger said. "They couldn't explain how—at least not in a way I understood."

"You hardly look overjoyed," Pilch observed. "What's the hitch?"

Trigger shrugged. "The time element. They live so long, they never really seem to understand how important time is to us. Getting the Sirens tamed down would take them a while."

"How much of a while?"

"That was a little blurry. Anything having to do with time tends to be with them. But I'm afraid they meant something like a couple of centuries."

Pilch shook her head. "We can't wait that long!"

"I know," Trigger said. "What I told them was that I was in a little bit of a hurry with the Sirens, so I'd better shop around for faster results."

"How did they react?"

"They seemed to think it was a good idea. So—I'm on the move again." Trigger smiled soberly. "What are the other approaches you had in mind?"

"At the moment, I have two suggestions," said Pilch. "There are a few Service xenos in whom I'd have some confidence in the matter. They're among our best operators. However, they're on an assignment outside the Hub. Even if they were to interrupt what they're doing—which they shouldn't—it would take them well over a month to get here."

"I'll be glad to take the specimen to them," said Trigger.

Pilch nodded. "We may wind up having you do just that. On the other hand, you may need to go no farther than Orado. There's a psi there who's a very capable xenotelepath. She isn't in the Service and doesn't let it be generally known that she's a psi. But, if she feels like it, it's quite possible she'll be able to determine whether the Sirens have intelligence, and whether it's a type and degree of intelligence that will permit communication with them. If that should turn out to be the case, we'd be over the first great hurdle."

"We certainly would be!" Trigger agreed. "How do I get in touch with her?"

Pilch produced a card. "Here's her name and current address. Send her a teleletter, outline the situation, inquire whether she'd like to investigate the specimen for you, and so forth. If she'll do it, she's your best present bet."

"I'll get at it immediately." Trigger studied the card, put it in her purse. "Telzey Amberdon. How much can I tell her?"

"Anything you like. Telzey's come by more information about the Federation's business than most members of the Council should have. But she doesn't spill secrets. I'll give you a Class Four Clearance to send her, to keep it legitimate."

"What kind of fee will she want?" asked Trigger. "I might have to make arrangements."

"I doubt she'll want a fee. Her family has plenty of money. She'll work for you if the proposition catches her interest. Otherwise, she won't."

"I should be able to make it sound interesting enough," Trigger remarked. "Supposing she gets herself into trouble over this like some of your xenos?"

Pilch said, "Nobody's suffered permanent damage so far. If she winds up needing therapeutic help, she'll get it. I wouldn't worry too much. Telzey's a little monster in some respects. But I'll be around the area a while, and you can contact me through any Service center." She looked at her timepiece. "We'll go to the Ceyce lab now, and get you equipped with your mind shield."

"Well, as to *that*," said Trigger, "I already have one. Not quite, but very nearly."

"Eh?"

Trigger explained about her resident Old Galactic, and that he'd been doing something to her nervous system for the past two days. They went to the Service lab anyway; Pilch wanted to know just what was being done to Trigger's nervous system. Tests established then that she, indeed, had a shield. It permitted contact with her conscious thoughts but sealed off the rest of her mind with a block which stopped the heaviest probe Pilch tried against it. However, it was a block which became non-

existent when Trigger didn't want it there.

"Any time I decide to get rid of it permanently, it will start fading away," Trigger said.

Pilch nodded. "I noticed there'd been provision made for that." She reflected. "Well, you won't need the shield I'd intended for you. They're giving you something that seems more effective. So I'll be running along."

She left. Around evening of that day, Trigger's Old Galactic let her know he'd finished his work. She went back to his home tree and held her wrist against it until he'd transferred again, thanked them all around for their trouble, and returned to her room. The letter to Telzey Amberdon was already prepared. It didn't mention the Old Galactics but was candid about almost everything else, specifically the subject of risks. Trigger flew in to Ceyce and had the letter dispatched to Orado at an interstellar transmitter station. Telzey Amberdon should receive it some six hours later.

That night, after the lights were out in the garden house and Trigger was asleep in her room, a visitor came to Mantelish's garden. Three Tainequas on their way to their quarters saw, but didn't notice, the cloaked shape moving toward them under the starblaze, went on talking in their soft voices, unaware of the shadow drifting

across their minds, unaware of the visitor passing them a few feet away.

Pilch moved deeper into the garden and into the dimness under the great trees. Now and then she stopped and stood quietly, head turning this way and that, like a sensing animal, to go on in a new direction. At last, she halted before the tree where Trigger had conferred with the Old Galactics, and stayed there.

Awareness stirred in the tree, slowly focused on her. There was a long pause. An inquiry came.

Pilch identified herself. After a time, the identification was acknowledged. *Your purpose?*

She brought up assorted unhurried impressions of Trigger's Siren specimen, of the Siren worlds, of the effects produced by Sirens, of their inaccessibility to psi contact . . .

Yes. The Hana species.

What did they know of it?

Pilch gathered presently that they'd never encountered a Hana before this. They'd had reports. Not recent ones. They'd believed the species was extinct.

Was it as dangerous as it appeared to be?

Yes. Very dangerous.

The slow exchange continued. In Pilch's mind, impressions formed. Time, space, and direction remained wavering, unstable concepts. But, by any human reckoning, it must have been very long

ago, very far away in the galaxy's vastness, that a race of conquerors brought Hanas to many civilized worlds. Presently those worlds were destroyed. The Hanas had swifter weapons than their ability to produce euphoria and mindless dependency in other species. Pilch watched as psi death lanced out from them, and all other minds in a wide radius winked out of existence. She saw great psi machines brought up to control the Hanas, and then those machines shredded into uselessness as their own energies stormed wildly through them. On a planet, while a semblance of its surface remained, the Hana species seemed indestructible, spreading and proliferating like a shifting green flood, sweeping up into furious life here as it was annihilated there.

They died at last when distant space weapons seared all worlds, many hundreds of worlds by then, on which they were to be found until no life of any kind remained possible. Then the great race the Hanas had fought hunted long and far, to make sure none remained alive in the universe.

But it appeared that one remote planet, at least, had been overlooked in that search.

Near daybreak, a small aircar lifted from a forested hillside a little to the north of Mantelish's garden and sped away toward Ceyce, Trigger awoke an hour

later, had breakfast, watched a few Tainequas moving about the garden from the veranda of her room, settled down to read. Around noon, the telewriter in Mantelish's office on the ground floor began clanging. Trigger hurried down, took a letter capsule from the receiver.

It appeared Telzey Amberdon's time next week would be mainly occupied with college graduation exams. However, she did want to see Miss Argee's Siren and discuss her plan with her, and would be pleased to meet her on Orado. If it happened to be convenient to Miss Argee, she had the coming week-end free—that being Days Seventy-one and Seventy-two of the standard year.

It was now Day Seventy. Trigger called the Psychology Service Center in Ceyce and left a message for Pilch. She packed quickly, loaded the Siren container into her aircar, and headed for Ceyce Port. Within the hour, she was on her way to Orado.

V

Trigger met Telzey Amberdon next morning in a room she'd taken in the Haplandia Hotel at the Orado City Space Terminal. She was startled for a moment by the fact that Telzey seemed to be at most seventeen years old. On reflection, she decided then that a capable young psi, one who knew

more Federation secrets than most Council members, might mature rather rapidly.

"Ready to be euphorized?" she asked, by and by.

Telzey nodded. "Let's check it."

Trigger switched off the psi block on the Siren container, and Siren euphoria began building up gradually in the room. Telzey leaned forward in her chair, watching the Siren. Her expression grew absent as if she were listening to distant voices. Trigger, having seen a similar expression on Pilch now and then, remained silent. After a minute or two, Telzey straightened, looked over at her.

"You can shield it again," she said.

Trigger restored the psi block. "What was it like?"

"Very odd! There was a wisp of psi sense for a moment—just as you switched off the block."

Trigger looked interested and thoughtful. "No one else reported that."

"It was there. But it was gone at once, and I didn't get it again. The rest was nothing. Almost like a negation of psi! I felt as if I were reaching into a vacuum."

Trigger nodded. "That's more or less how the Service xenos describe the sensation. I brought along a file of their reports. Like to see them?"

Telzey said she would. Trigger produced the file; and Telzey sat down at a table with it and began



scanning through the reports. Trigger watched her. A likable sort of young person . . . Strong-willed probably. Intelligent certainly. Capable of succeeding where Pilch's xenos had failed? Trigger wondered. Still, Pilch wouldn't have referred to her as a little monster without reason.

The little monster presently closed the file and glanced over at Trigger.

"That certainly *is* a different kind of psi creature!" she remarked. "Different from anything I've come across, anyway. I don't know if I can do anything with it. I'm not your last hope, am I?"

Trigger smiled briefly. "Not the last. But the next one's more than a month's travel time away."

"Do you want me to try? Now that you've seen me?"

Trigger hesitated. "It's not exactly a matter of wanting anyone to try."

"You're worried, aren't you?" Telzey asked.

"Yes, I'm worried," Trigger acknowledged. "I seem to be getting a little more worried all the time."

"What about?"

Trigger bit her lip gently. "I can't say specifically. It may be my imagination. But I don't think so. It's a feeling that we'd better get this business with the Sirens straightened out."

"Or something might happen?"

"That's about it. And that the situation might be getting more critical the longer it remains unsettled."

Telzey studied her quizzically. "Then why aren't you anxious to have me try the probe?"

Trigger said, "There hasn't been too much trouble so far. In the labs, where they've been trying to modify the Sirens biologically, there's been no trouble at all. Except, of course, that some people got addiction symptoms before they started using psi blocks and mind shields. But you see, all they've accomplished in the labs is to put some checks on the Sirens." She indicated the container. "Like stopping this one's growth, keeping the proliferation cycles from getting started, and so on. Meanwhile, there've been indications that the

chromosomal changes involved have gradually begun to reverse—which, I've been told by quite a number of people, is impossible."

Telzey said, "The midget here might start to grow again?"

"Yes, it might. What it means is that the labs haven't really got anywhere. Now, the Psychology Service xenos didn't get too far either, but they did learn a few definite things about the Siren. They got into trouble immediately."

Telzey nodded.

"And you," Trigger said, "are supposed to be better than the Service xenos. You should be able to go further. If you do, it's quite possible you'll get into more serious trouble than they did."

Telzey said after a moment, "You think the Siren doesn't intend to change from what it is? Or let us find out what it really is?"

"It almost looks that way, doesn't it?"

"On the psi side it might look that way," Telzey agreed. She smiled. "You know, you're not trying very hard to push me into this!"

"No," Trigger said. "I'm not trying to push you into it. I don't feel I should. I feel I should tell you what I think before you decide." Telzey looked reflective. "You've told other people?"

Trigger shook her head. "If I started talking about it, generally,

it might turn us back to the extermination program. I think that's the last thing that should happen." She added, "Pilch probably knows. She's looked around in my mind now and then, for one reason and another. But she hasn't said anything."

"Pilch is the one who recommended me to you?" Telzey asked.

"Yes. Have you met?"

Telzey shook her head. "I've never heard of her. What's she like?"

Trigger considered.

"Pilch is Pilch," she said. "She has her ways. She's a very good psi. She seems to be one of the Service's top executives. She's a busy lady, and I don't think she'd bother herself for a minute with the Sirens if she thought they weren't important. She told me there was a definite possibility you'd be able to get into communication with our specimen—that's assuming, of course, there's something there that can communicate." Trigger thought again, shrugged. "I've known Pilch nearly two years, but that's almost all I can tell you about her."

Telzey was silent for over a minute now, dark-blue eyes fixed reflectively on Trigger.

"If I told you," she said suddenly, "that I didn't want to get involved in this, what would you do?"

"Get packed for a month's travel plus," Trigger said promptly.

"I don't think it will be at all safe to push ahead on the psi side here, but I think it will be safer generally than not pushing ahead."

Telzey nodded.

"Well, I am getting involved," she said. "So that's settled. We'll see if Pilch is right, and it's something I can handle—and whether you're right, and it's something that has to be handled. I can't quite imagine the Sirens as a menace to the Federation, but we'll try to find out more about them. If I don't accomplish anything, you can still pack up for that month's trip. How much time can you spend on Orado now?"

Trigger said, "As much time as it takes, or you're willing to put in on it."

Telzey asked, "Where will you stay? We can't very well work in the Haplandia."

"We certainly can't," Trigger agreed. "We'd have half the hotel in euphoria if we left the Siren unshielded for ten minutes. I haven't made arrangements yet. The labs where they work on Sirens are all a good distance away from population centers, even though the structures are psi-blocked. So I'll be looking for a place that's well out in the country, but still convenient for you."

"I know a place like that."

"Yes?"

"My family has a summer house up in the hills," Telzey said. "Nobody will be using it the next

couple of months. There's Ezd Malion, the caretaker; but he and his wife have their own house a quarter of a mile away."

Trigger nodded. "They'll be safe there. Unless there are special developments. The Siren euphoria couldn't do more than give them sunny dispositions at that distance."

"That's what I thought from the reports," said Telzey. "And we can keep the Malions away from the house while we're working. There's nobody else around for miles. It's convenient for me—I can get there from college in twenty minutes. If there isn't something you want to do, why don't we move you and the Siren in this afternoon?"

VI

The Hana dwarf dreamed in its own way occasionally. Its life of the moment had been a short one and might not be extended significantly; but its ancestral memory went back for a number of generations before it began to fade, and beyond that was a kind of memory to which it came only when it withdrew its attention wholly from the life of the moment and its requirements. It had taken to doing it frequently since realizing it was on a Veen world and no longer in contact with its kind.

That form of memory went back a long way to the world on

which the Hanas originated, and even to the early period of that world when they gained supremacy after dangerous and protracted struggles with savage species as formidable as they, and came at last to the long time in which the world remained in harmony and they kept it so, living the placid and thoughtful plant existence they preferred, but not unaware of what went on outside. Disruptions occurred occasionally when some form of scurrying mobile life, nervously active, eternally eating or being eaten, began to become a nuisance, to crowd out others, or attempt to molest the Hanas. Then the Hanas would beckon that overly excitable species to them and start it on the path which led it eventually to the quietly satisfactory existence of the plant.

It was a good time, and the Hana dwarf now lived there often for a while before returning, strengthened, to the life of the moment and the knowledge of being among the Veen. There was little else to do. The Veen held it enclosed in a cage of energy, difficult to penetrate and opened only when they came with their prying minds and mind machines to seek out and enslave the captured Hana mind, precisely as they had done in other days. They'd learned much in the interval, if not greater wisdom and less arrogance. The Hana dwarf was aware of the manipulations which stopped its growth and

prevented it from developing and distributing its seed. But such things were of no significance. They could be undone. The question was whether the Veen could reach its mind.

It hadn't believed they could. It was more formidably armed than any Hana had been in the times of the Veen War; if its defenses failed, the touch of its thought would kill other minds in moments. But it was less sure now. The Veen's first probes barely reached its defenses, broke there; and a brief period of quiet followed. But they were persistent. Indications came that another attempt was being carefully prepared, with mind qualities involved which had not been noticeable before.

It would warn them, though Veen had not yet been known to respond sensibly to a warning. They were the race which knew no equals, which could tolerate only slaves. If they persisted and succeeded, the Hana would emerge to kill, and presently to die. A single pulse would be enough to notify the Three Worlds, long since alerted, and waiting now with a massed power never before encountered by Veen, that the Veen War had been resumed.

The Hana shaped its warnings and set them aside, to be released as seemed required. Then, with its several deaths prepared, it, too, waited, and sometimes dreamed.

Toward evening, four days after Trigger and the Siren specimen moved into the Amberdon summer house, Telzey was on her way there by aircar. It had been a demanding day at college, but she was doing very well in the exams. When she left Pehanron, she'd felt comfortably relaxed.

Some five minutes ago then, her mood shifted abruptly. An uneasy alertness awoke in her. It wasn't the first time she'd felt that way during the past few days.

The Siren? From behind a psi block and over all these miles? Not likely, but perhaps not impossible either. She hadn't made much headway in the investigation over the weekend and the last two evenings, and hadn't tried to. That was a strange being! Under the mechanical euphoric effect seemed to lie only the empty negation which had met her first probe. The Service's translating machines had reported nothing at all, but most of the Service xenotelepaths also had sensed the void, the emptiness, the vacuum. Some of them eventually found something in the vacuum. They weren't sure of what they'd found; but they'd stirred up a violence and power difficult to associate with the midget Siren. Mind shields had been hard tested. Some shields weren't tight enough, or resistant enough; and as a result, the Service had a few lunatic xenos around for a while.

Even without Trigger's fore-

bodings, it wouldn't have looked like a matter to rush into. When the exams were over, she could settle down to serious work on the Siren. All she'd intended during the week was to become acquainted with it.

In doing even that much, had she allowed it to become acquainted with her? She wasn't sure. Something or other, at any rate, seemed to have developed an awareness of her. Otherwise, she'd had no problems. The addictive effect didn't bother her; that could be dampened or screened out, and whatever lingered after a period of contact was wiped from her mind in seconds.

The something-or-other did bother her.

Telzey turned the aircar into the mouth of a wide valley. It was between winter and spring in the hills, windy and wet. Snow still lay in the gullies and along the mountain slopes, but the green things were coming awake everywhere. The Amberdon house stood forty miles to the north above the banks of a little lake . . .

There was this restlessness, a frequent inclination to check the car's view screens, though there was almost no air traffic here. Simply a feeling of something around! Something unseen.

When it happened before she'd suspected there might be a psi prowling in her mental neighborhood, somebody who was taking

an interest in her. Since such uninvited interest wasn't always healthy, she'd long since established automatic sensors which picked up the beginnings of a scanning probe and simultaneously concealed and alerted her. The sensors hadn't gone into action.

So it shouldn't be a human psi hanging around. Unless it was a psi with a good deal defter touch than she'd encountered previously. Under the circumstances, that, too, wasn't impossible.

If it wasn't a human psi, it almost had to be a Siren manifestation.

The feeling faded before she reached the house and brought her Cloudsplitter down to the carport. Another aircar stood there, the one Trigger had rented for her stay on Orado.

During the past two evenings, they'd established a routine. When Telzey arrived from college, she and Trigger had dinner, then settled down in the room Gilas Amberdon used as a study when he was in the house. Its main attraction was a fine fireplace. They'd talk about this and that; meanwhile the Siren's unshielded container stood on a table in a corner of the room, and Telzey's thoughts drifted about the alien strangeness, not probing in any way but picking up whatever was to be learned easily. She soon stopped getting anything new in that manner; what

was to be learned easily about the Siren remained limited. Some time before midnight, they'd restore the psi block, and Telzey went off to Pehanron.

But before she left, they turned on the lights in the grounds outside for a while. The very first night, the day Trigger and the Siren moved in, they'd had a rather startling experience. They were in the study when they began to hear sounds outside. It might have been tree branches beating against the wall in the wind, except that no tree grew so close to the house there. It might even have been an unseasonal, irregular spattering of hail. The study had no window, but the adjoining room had two, so they went in, opened a window and looked out.

At once, something came up over the sill with a great wet flap of wings and tail and drove into the room between them, bowling Telzey over. Trigger yelped and slammed the window shut as another pair of wings boomed in from the windy dusk with more shadowy shapes behind it. When she looked around, Telzey was getting to her feet and the intruder had disappeared into the house. They could hear it flapping about somewhere.

"Are you hurt, Telzey?"

"No."

"What in the world is that thing? There's a whole mess of them outside!"

"Eveers. They're on spring migration. A flock was probably settling to the lake and got in range of the Siren."

"Good Lord, yes. The Siren! We should have realized—what'll we do with the one in the house?"

"The first thing we'd better do is get the Siren shielded," said Telzey.

Trigger cocked her head, listening. "The, uh, eveer is in the study!"

Telzey laughed. "They're not very dangerous. Come on!"

The eveer might not have been a vicious creature normally, but it had strong objections to being evicted from the study and put up a determined fight. They both collected beak nips and scratches, were knocked about by solid wing strokes and thoroughly muddled by the eveer's wet hide, before they finally got it pinned down under a blanket. Then Trigger crouched on the blanket, panting, while Telzey restored the psi block. After that, the eveer seemed mainly interested in getting away from them. They carried it to the front door between them, bundled in the blanket, and opened the door. There they recoiled.

A sizable collection of Orado's local walking and flying fauna had gathered along the wall of the house. But the creatures were already beginning to disperse, now that the Siren's magic had faded; and at the appearance of the two humans, most of them took off

quickly. Trigger and Telzey shook the ever out of the blanket, and it went flapping away heavily into the night.

It took them most of an hour to tend to their injuries and clean up behind it. After that, they ignored unusual sounds outside the house when the container's psi block was off.

Other things were less easy to ignore.

The night Telzey started back to Pehanron after the weekend was the time she first got the impression that something unseen was riding along with her. Psi company, she suspected, though her sensors reported nothing. She waited a while, relaxed her mind screens gradually, sent a sudden quick, wide search-thought about, with something less friendly held in readiness, in case it was company she didn't like. The search-thought should have caught at least a trace of whoever or whatever was there. It didn't.

She remained behind her screens then, waiting. The feeling grew no stronger; sometimes it seemed to weaken. But it was a good five minutes before it faded completely.

It came back twice in the next two days. Once in the house while she was in the study with Trigger, once on the way to the house. She didn't mention it to Trigger; but that night, when it was getting time for her to leave, she said, "I

think I'll sleep here tonight and start back early in the morning."

"Be my guest," Trigger said affably. She hesitated, added, "The fact is I'll be rather glad to know you're around."

Telzey looked at her. "You get lonesome at night in this big old house?"

"Not exactly lonesome," Trigger said. "I've never minded being by myself." She smiled. "Has your house ever had the reputation of being haunted?"

"Haunted? Not for around a hundred years. You've had the impression there's a spook flitting about?"

"Just an odd feeling occasionally," Trigger said. She paused, added in a changed voice, "And by coincidence, I'm beginning to get that feeling again now!"

They stood silent then, looking at each other. The feeling grew. It swelled into a feeling of bone-chilling cold, of oppressive dread. It seemed to circle slowly about them, drawing closer. Telzey passed her tongue over her lips. Psi slashed out twice. The feeling blurred, was gone.

She turned toward the Siren container. Trigger shook her head. "The psi block's on," she said. "It was on the other times, too. I checked."

And the psi block was on. Telzey asked, "How often has it happened?"

Trigger shrugged. "Four or five

times. I'll come awake at night. It'll last a minute or two and go away."

"Why didn't you tell me?"

"I didn't want to disturb you," Trigger said. "It wasn't as strong as this before. I didn't know what it was, but it didn't seem to have anything to do with the Siren." She smiled, a trifle shakily. "An Amberdon ghost I could take."

"Let's sit down," Telzey said. "It wasn't an Amberdon ghost, but it was a ghost of sorts."

They sat down. "What do you mean?" Trigger asked.

Telzey said, "A psi structure. Something with some independent duration. A fear ghost. A psi mind made it, planted it. It was due to be sensed when we sensed it."

Trigger glanced at the container. "The Siren?"

"Yes the little Siren." Telzey blinked absently, fingering her chin. "There was nothing human about that structure. So the Siren put it out while the block was off. It's telling us not to fool around with it . . . But now we *will* have to fool around with it!"

Trigger looked questioningly at her.

"It means you were right," Telzey said. "The Siren has intelligence. It knows there's somebody around who's trying to probe it, and it doesn't want to be probed. It's tried to use fear to drive us away. Any psi mind that can put out a structure like that is very good! Dangerously good."

She shook her head. "I don't think anyone could say exactly what a whole world of creatures who can do that mightn't be able to do otherwise!"

"Three worlds," said Trigger.

"Yes, three worlds. So the Siren operation can't just stop. They don't know enough about us. They might think we're very dangerous to them, and, of course, we are dangerous. The three worlds are there, and sooner or later somebody's going to do something stupid about them. And something will get started—if it hasn't started already." She glanced at Trigger, smiled briefly. "Until now, I was thinking it might be only your imagination! But it isn't. This is a really bad matter."

Trigger said after a moment, "I wish it had been only my imagination!" She looked at the Siren container. "You still think you can handle it?"

Telzey shrugged. "I wouldn't know by myself. But I'm sure Pilch gave that careful consideration."

Trigger reflected, tongue tip between lips, nodded. "Yes, she must have. It seems you've been pushed into something, Telzey."

"We both have."

Trigger sighed. "Well, I can't blame her too much! It has to be done, and the Service couldn't do it—at least not quickly enough. But I won't blame you at all if you want to pull out."

"I might want to pull out," Telzey admitted. "It's more than I'd counted on. But I'd be going around worrying about the Sirens then, like you've been doing. We know more now to be worried about."

"So you're staying?"

"Yes."

Trigger smiled. "I can't say I'm sorry! Look, it's getting late, and you'll have to be off to college early. Let's talk about strictly non-erie things for a little, and turn in."

So they talked about non-erie matters, and soon went to bed, and slept undisturbed until morning, when Telzey flew off to Pehanron College.

That evening, she slipped a probe lightly into the psi-emptiness of the Siren—an area she'd kept away from since her first contact with it. She thought presently it didn't seem quite as empty as it had. There might be something there. Something perhaps like a vague, distant shadow, only occasionally and briefly discernible.

She withdrew the probe carefully.

"Let's leave the psi block on until I've finished with the exams," she told Trigger later. "I've picked up as much as I can use for a start." She wasn't so sure now of the psi block's absolute dependability when it came to the Siren. But it should act as a temporary restraint.

Trigger didn't comment. Telzey slept in the house the rest of the week, and nothing of much significance happened. What remained of the exams wasn't too significant either; she went breezing through it all with only half her attention. Then the end of the week came, and she moved into the summer house. In three weeks, she'd be attending graduation ceremonies at Pehanron College. Until then, her time was her own.

VII

It was early on the first morning after the exams that Telzey had her first serious session with the Siren. She had closed the door to the study and moved an armchair to a spot where she could observe the container. Trigger wasn't present; she had stayed out of the study to avoid distracting Telzey, and to handle interruptions like ComWeb calls. Ezd Malion, the caretaker, usually checked in before noon to get shopping instructions.

Telzey settled herself in the chair, relaxed physically. Mentally there'd be no relaxing. If the Siren entity followed the reaction pattern described in the Service reports, she shouldn't be running into immediate problems. But it might not stay with the pattern.

Her probe moved cautiously into the psi-emptiness. After a time, she gained again the impression of a

few days before: it wasn't as empty as it had appeared at first contact. Something shadowy, distant, seemed to be there.

She began to work with the impression. What did she feel about it? A vague thing—and large. Cold perhaps. Yes. Cold and dark . . .

It was what she felt—no more than that. But her feelings were all she had to work with at this stage. Out of them other things could develop. There was this vague, dark, cold largeness then, connected with the Siren on the study table. She tried to gain some impression of the relationship.

An impression came suddenly, a negative one. The relationship had been denied. Afterwards, the darkness seemed to have become a little colder. Telzey's nerves tingled. There was no change otherwise, but she'd had a response. Her psi sensors reached toward the fringes of the darkness, seemed to touch it, still found nothing that allowed a probe. She had a symbol of what was there, not yet its reality. But the search had moved on a step.

Then there was an interruption. She knew suddenly she wasn't alone in the study. This was much more definite than any previous feeling that there might be someone or something about. She still sensed nothing specific, but the hair at the nape of her neck was trying to lift, and the skin of her back prickled with awareness of another's presence in the room.

Telzey didn't look around, knowing she'd see no one if she did. Instead, she flicked a search probe out suddenly. As suddenly the presence was gone.

She sat quiet a moment, returned her attention to the symbol. Nothing there had changed. She withdrew from it, stood up, turned the container's psi block back on, and looked at her watch. About an hour had passed since she'd entered the study.

She found Trigger in the conservatory, tending to the plants under the indoor sun. "Trigger," she said, "did you happen to be thinking about me a few minutes ago?"

"Probably," Trigger said. "I've been thinking about you right along, wondering how you were doing. Why?"

"Has there ever been anything to indicate you might be a psi?"

Trigger looked surprised.

"Well," she said, "I understand everybody's a bit of a psi. So I suppose I'm that. I've never done anything out of the ordinary though. Except perhaps—" She hesitated.

"Except perhaps what?" Telzey asked.

Trigger told her about the Old Galactics and her contacts with them.

"Great day in the morning!" Telzey said astounded, when Trigger concluded. "You certainly have unusual acquaintances!"

"Of course, no one's to know they're there," Trigger remarked.

"Well, I won't tell."

"I know you won't. You think it might mean I'm a kind of telepath?"

"It might," Telzey said. "It wouldn't have to. They may simply have themselves tuned in on you." She stood a moment, reflecting. "I ran into a heavy-duty psi once who didn't have the faintest idea he was one," she said. "It was a problem because all sorts of extraordinary things kept happening to him and around him. Right now, anything like that could be disturbing."

Trigger looked concerned. "Have there been disturbances?"

"I haven't noticed anything definite," Telzey said untruthfully. "But I've been wondering."

"Could you find out about me if I undid that mind shield they gave me?"

Telzey sat down. "Let's try," she said.

Trigger wished the shield out of existence. Some little time passed. Then Telzey said, "You can put the shield back."

"Well?" Trigger asked. "Am I?"

"You are," Telzey said absently. "I thought you might be, from the way you've been worrying about the Sirens." She shook her head. "Trigger, that's the most disorganized psi mind I've ever contacted! I wonder why Pilch never mentioned it."

Trigger hesitated. "Now that

you've mentioned it," she said. "I believe Pilch did suggest something of the kind on one occasion. I thought I'd misunderstood her. She didn't refer to it again."

"Well, if you like," said Telzey, "we can take a week off after we're through with the Siren, and see if we can't make you operational."

Trigger rubbed her nose tip. "Frankly," she said, "I doubt that I'd want to be operational."

"Why?"

"You and Pilch seem to thrive on it," Trigger said, "but I've met other psis who weren't cheery people. I suppose you can pick up a whole new parcel of problems when you have abilities like that."

"You pick up problems, all right," Telzey acknowledged.

"That's what I thought. And I," Trigger said, "seem to find all the problems I can handle without adding complications. Could that disorganized psi mind of mine do anything to disturb you when you're trying to work with the Siren?"

Telzey shook her head. Trigger, psi-latent, hadn't been unconsciously responsible for those manifestations, couldn't have been. Neither was the Siren. This time, there'd been, for a moment, a decidedly human quality about the immaterial presence.

So the Psychology Service was keeping an eye on proceedings here. She'd half expected it. And they'd assigned an operator of ex-

ceptional quality to the job—*she* couldn't have prowled about an alerted telepath and remained as well concealed.

Nor, Telzey thought, was that the only concealed high-quality psi around. While Trigger was talking about the Old Galactics, she'd recalled that flick of mind-stuff she caught the moment the Siren container came unshielded in the Haplandia Hotel.

It seemed the Old Galactics, too, had an interest in the Siren specimen, and were represented in the summer house . . .

Did either of them know about the other? Did the Siren entity know about either of them, or suspect it had an occupant? It was nothing she could mention to Trigger—there was too much psi involved all around, and Trigger's surface thoughts were accessible to any telepath who wanted to follow them.

She'd have to await developments—and meanwhile push ahead toward the probe. Around that point, everything should start falling into place. It would have to.

She told Trigger what she'd accomplished so far, added, "I've probably got the contact process started. This afternoon I'll pick the symbol up again and see." She yawned, stretched slowly. "How about we go for a long walk before lunch? This is great hiking country."

They went down to the end of

the grounds, past the house where Ezz Malion and his wife lived, and on to the banks of the lake. The sun was out that morning; it was chilly, blustery, refreshing. They followed narrow trails used more often by animals than by people. It was over an hour before they turned back for lunch.

Early in the afternoon then, Telzey went into the study and closed the door. She emerged four hours later.

Trigger regarded her with some concern. "You look pretty worn out!"

"I am pretty worn out," Telzey acknowledged. "It was hard work. Let's go have some coffee, and I'll tell you."

She'd picked up her symbol with no trouble—a good sign. She settled her attention on it, and waited. There'd been changes, she decided presently. It was as if a kind of life were seeping into the symbol, accumulating there. Another good sign. No need to push it now; she was moving in the right direction.

That might have gone on about an hour. Physically Telzey was feeling a little uncomfortable by then, which again could be counted, technically, a good sign, though she didn't like it. There was a frequent shivering on her skin, moments when breathing seemed difficult, other manifestations of apprehension. What it meant was that she was getting close.

Then there was an instant when

she wasn't close, but there. Or *it* was there. The symbol faded as what had been behind it came slowly through. This was no visualization, but reality as sensed by psi. It was the darkness, the cold, in the false emptiness. It simmered with silent power. It was eminently forbidding.

It was there—then it wasn't there. It seemed to have become nonexistent.

But she needed no symbols to return to it now. What she had contacted, she could contact again. It was in her memory; and memory was a link. She could draw herself back to it.

She did, quickly lost it once more. Now there were two links. All she needed was patience.

Any feeling of passing time, all awareness of the room about her, of the chair in which she sat, even of her body, was gone. She was mind, in the universe of mind where she moved and searched, tracing the thing she had contacted, finding it, establishing new connections between herself and it. She lost it again and again, but each time it was easier to find, less difficult to hold. It was a great fish, and she a tiny fisherman, not fastening the fish to herself, but herself to the fish. Finally, the connection was stable, unchanging. When she was sure of that, she broke it. She could resume it whenever she chose.

At that point, she became con-

scious of the other reality, of her physical self and her surroundings.

And—once more—of having uninvited company.

This time, she ignored the presence. It faded quietly from her awareness as she opened her eyes, sat up in the armchair . . .

"I think we're almost there," she told Trigger. "The thing's a structure, a psi structure. It's what the Service xenos found and tried to probe. And I can believe it bounced them—it's really charged up!"

"You're going to try to probe it?" Trigger asked.

Telzey nodded. "I'll have to. There's been no mind trace of the Siren, so that structure must act as its shield. I'll have to try to work through it. How, I won't know till I find out what it's like." She was silent a moment. "If it bounces me, too, I don't know what else we can do," she said. "But we'll start worrying about that then. I do have very good shields. And if I can get one solid contact with the Siren mind, we may have the problem solved. Unless they're basically murderous, of course. But I agree with you that they don't really seem to be that."

There were other factors involved. But that was still nothing to talk to Trigger about. "So everything's set up for the probe now," Telzey concluded. "Next time I'll try it. But I want to be a lot fresher for that, so it won't be

tonight. We'll see how I feel tomorrow."

They turned in early. Telzey fell into sleep at once, like drifting deep, deep down through a cool dark quiet sea . . . Some time later then, she found herself standing in the Siren's container.

It wasn't exactly the container, though there was a shadowy indication of its walls in the distance. A kind of cold desert stretched out about her, and she stood at the base of the Siren. A Siren which twisted enormously up into an icy sky, gigantic, higher than a mountain, huge limbs writhing. A noise like growing thunder was in the air; the desert sand shook under her, and her feet were rooted immovably in the sand. Then she saw that the Siren was tilting, falling toward her, would crush her. She heard herself screaming in terror.

She awoke.

She sat up in bed, breathing in quick short gasps. She looked around the dark room, reached for the light switch. As she touched it, light blazed in the hall beyond the door "Trigger?" she called.

From the direction of Trigger's room came a shaky "Yes?"

"Wait a moment!" Telzey climbed out of bed, started toward the door. Trigger met her there, robe wrapped around her, face pale, hair disheveled. "What's the matter?" Telzey asked.

Trigger tried to smile. "Had a

dream—a nightmare. *Whew!* Going down to the kitchen for some hot milk to settle myself."

"A nightmare?" Telzey stared at her. "Wait—I'll come along."

They'd had the same dream. A dream apparently identical in all respects, except that in Trigger's dream, it was Trigger who was about to be crushed by the toppling monster Siren. Sitting in the kitchen, sipping their hot milk, they discussed it, looking at each other with uncertain eyes. Something had come into their minds as they slept—

"That Old Galactic shield of yours," Telzey pointed out, "is supposed to keep anything from reaching your subconscious mind processes—which includes the dream mechanisms."

Trigger gave her a startled glance.

"Unless I allow it!" she said. "And I think I did allow it."

"What?"

Trigger nodded, frowned, trying to remember. "I was half asleep," she said slowly. "Something seemed to be telling me to dissolve the shield. So I did."

"Why?"

Trigger shrugged helplessly. "It *seemed* perfectly all right! I wasn't surprised or alarmed—not until I started dreaming." She reflected, shook her head. "That's all I remember. I suppose there was another of those ghost structures floating around?"

Telzey nodded. "Probably." She couldn't recall anything that had happened before she started dreaming. "Some general impression—warning, threat," she said. "With a heavy fear charge."

"How could we have turned that into the same dream?"

Telzey said, "We didn't. Your mind was wide open. I'm a telepath." A dream could be manufactured in a flash, from whatever material seemed to match the impulse that induced it. "One of us whipped up the dream," she said. "The other shared it. We came awake almost at once then."

"That Siren," said Trigger after a moment, "really doesn't want to be probed."

"No, not at all. And it may be aware that I've got as far as its shield."

Two other psi minds around here, Telzey thought, should also be aware of that fact. The Psychology Service would hardly be trying to discourage her from the probe. But the observer the Old Galactics had left planted in the Siren might have some reason for doing it—and might have the ability to induce a warning nightmare. She wished she had some clue to the interest that ancient race was taking in the Sirens.

They finished their milk, sat talking a few minutes longer, decided there was no sense sitting up the rest of the night, and went back to bed. They left the light on

in the hall outside their rooms. Somewhat to Telzey's surprise, she felt herself fall asleep again almost as soon as her head touched the pillow.

VIII

They awoke to a disagreeable day. The sky was gloomy; a wind blew in cold gusts about the house; and there were intermittent falls of rain. Breakfast was a silent affair, each withdrawn into her thoughts. When they'd finished, Trigger went to a window and looked out. Telzey joined her. "Gruesome weather!" Trigger remarked darkly. "I feel depressed."

"So do I," said Telzey.

Trigger glanced at her. "You don't think it's the weather, do you?"

"No."

"It's in the house all around us," Trigger said, nodding. "I've felt it since I woke up. As if there were something unpleasant about that I might see or hear at any moment. More of that ghost stuff, isn't it?"

"Yes. It may wear off." But Telzey wasn't so sure it would wear off, and whether the entity behind the psi block wasn't reaching them now through the block. This was a subtler assault on their nerves, the darkening of mood, uneasiness, a prodding of anxieties—all too diffused to counter.

An hour later, it didn't seem to be wearing off. "You shouldn't try

the probe while you're feeling like this, should you?" Trigger asked.

Telzey shook her head. "Not if I can help it—but I don't think I should put it off too long either."

They were vulnerable, and they'd stirred something up. Even left alone, it wouldn't necessarily settle down. It might keep undermining their defenses for hours, or shift to a more definite attack. The probe must be attempted, and soon. The Sirens existed, were an unpredictable factor; something had to be done. If she waited, she might be reduced to incapability. That could be the intention.

"Let's go outside and tramp around a while," Trigger said. "Maybe it will cheer us up. I usually like a good rainy day, really."

They donned rain capes and boots, went down to the lake. But the walk didn't cheer them up. The wind stirred the cold lake surface, souged through the trees about them. The sky seemed to be growing darker; and the notion came to Telzey that if she looked closely enough, she'd be able to make out the giant Siren of their dream writhing among distant clouds. She stopped short, caught Trigger by the arm.

"This isn't doing any good!" she said. "It's focused on us, and we're dragging it around with us here. Let's go back, pick up swim gear, and clear out! I know a beach where it won't be rainy and cold. We can be there in an hour."

They sped south in the Cloudsplitter and came down on a beach, golden and hot under a nearly cloudless sky. The wind that swept it was a fresh and happy one. They swam and tumbled in the surf, spirits lifting by the minute. They came out and sunned, talked and laughed, swam again, collected a troop of bronzed males, let themselves be taken to lunch, shook off the troop, fled fifty miles east along the beach, went back to the water for a final dip where breakers rose high, emerged exhausted and laughing ten minutes later. "Now let's go tackle that Siren!"

They flew north again, dropping down at a town en route to buy two tickets to the currently most popular live show in Orado City. Just what would happen when the probe began seemed a rather good question. Enough had happened, at any rate, to make them feel the Malions shouldn't be anywhere in the area at the time. They stopped off at the caretaker's house, explained they'd intended taking in the show that night, but found they couldn't make it; so there were two expensive tickets on hand which shouldn't go to waste. Ezd and wife were on their way to Orado City thirty minutes later.

Parked at the northern end of the grounds, Telzey and Trigger watched the caretakers leave. The Cloudsplitter lifted then, slid down into the carport of the summer house. They went in.

The house was quiet. If anything had taken note of their return, it gave no indication. They got arranged quickly in the study. Trigger would be sitting in on this session. The finicky part of the work was done; someone else's presence, the subtle whisper of half-caught surface thoughts and emotional flickerings nearby when her sensors were tuned fine, could no longer be a distraction to Telzey. And company would be welcome to both of them now. Trigger took a chair to the right of the one Telzey had been using, a dozen feet away. "Ready?" Telzey asked from beside the Siren container.

Trigger settled herself. "When you are."

Telzey switched off the psi block. Something came into the study then. Telzey glanced at Trigger. No, Trigger hadn't noticed. Telzey went slowly to her chair, sat down.

The presence was back. *That* didn't surprise her.

But Trigger . . .

She looked over at Trigger. Trigger gave her a sober smile. There was alert intelligence in her expression, along with concern she wasn't trying to hide. Trigger, undeniably, was in that chair, aware and awake. But in a sense she'd vanished a moment ago. The normal tiny stirrings of mind, of individuality, had ceased. There was stillness now, undisturbed.

Telzey slid a probe toward the

stillness. It didn't seem to touch anything, but it was stopped. She drew it back.

A shield of totally unfamiliar type. Trigger evidently didn't realize it was there. But it sealed her off from outside influences like undetectable heavy armor.

Things had begun to add up.

Telzey checked her own safeguards briefly. Mind screens which might be the lightest of veils, meant only to obscure her from psi senses while she peered out, so to speak, between them. Or, on other occasions, tough and resilient shields which had turned the sharpest probe she'd ever encountered and held up under ponderous onslaughts of psi energy. They could shift in an instant from one extreme to the other. Sometimes, though rarely now, they disappeared completely.

She restored contact—and it was back at once before her: the cold darkness, the emptiness that wasn't empty, the sense of forbidding, repelling power. She scanned cautiously along the impression but could make out no more about it than before.

So then the initial probe! A sensing psi needle reached, touched, drove in, withdrew. As it withdrew, something wrenched briefly and violently at Telzey.

She waited. The xenotelepathic faculty was an automatic one, operating in subconscious depths beyond her reach. She didn't know

why it did what it did. But when she touched an alien mind, it began transforming alien concepts to concepts sufficiently human in kind so that she understood them; and if she wanted to talk to that mind, it turned her concepts into ones the alien grasped. Usually the process was swift; within a minute or two there might be the beginnings of understanding.

No understanding came here. Her screens had gone tight as something gripped and twisted her. When she relaxed them deliberately again, nothing else happened.

A deeper probe then. She launched it, braced for the mental distortion.

It came. The shields stiffened, damping it, but she had giddy feelings of being dragged sideways, stretched, compressed. And the probe was being blocked. She drew it back. Strangeness writhed for a moment among her thoughts and was gone. Echo, at last, of alien mind—of the mind that wanted no contact!

The sense of violent distortion ended almost as soon as her probe withdrew. The dark lay before her again, sullen and repelling. A psi device, assembled by mind. A shield, a barrier. A formidable one. But she'd touched for a moment the fringes of the alien mind concealed by the barrier, and now contact with it, whether it wanted contact or not, might be very

close. She'd have to do more than she'd done. She decided to trust her shields.

She paused then, at a new awareness.

She wasn't alone. The presence had followed. More than a presence now. Mind, human mind, behind heavy shielding.

"What do you want?" Telzey asked.

Thought replied. "After you make the contact, you may need support."

She would. "Can you give it?"

"I believe so. Be ready!" The impression ended.

Telzey moved in her shields toward the dark barrier, reached it. The barrier awoke like a rousing beast. Her probe stabbed out, hard and solid. The barrier shook at her savagely, and mind-strangeness flickered again through her thoughts. She caught it, tagged it, felt incomprehensibility and an icy deadliness in the instant before it was gone. Now there had been contact—a thread of psi remained drawn between herself and the alien mind, a thin taut line which led through the barrier. Following the line, she moved forward into the barrier, felt a madness of power surge up about her.

"Link with me quickly before—"

Vast pressures clamped down. Telzey and the other spun together through the thunders of chaos.

She'd joined defenses before the

barrier struck. With whom, she didn't know, and there was no time just now to find out. But she'd felt new strength blend with hers in that moment, and the strength was very, very useful. For here was pounding confusion, a blurring and blackening of thought, a hideous distorting and twisting of emotion. The barrier was trying to eject her, force her back, batter her into helplessness. It was like moving upstream through raging and shifting currents.

But the double shield absorbed it. And her psi line held. For a time she wasn't sure she was moving at all through the psi barrier's frenzies. Then she knew again that she was—

IX

She was lying in bed in a darkened room and didn't have to open her eyes to know it was her bedroom in the summer house. She could sense its familiar walls and furnishings about her. How she'd got there, she didn't know. Her mind screens were closed; not drawn into a tight shield, but closed. Automatic precautionary procedure.

Precaution against what?

She didn't know that either.

Something evidently had happened. She felt very unpleasantly weak; and it wasn't the weakness of fatigued muscles. Most of her strength seemed simply absent.

There were no indications of physical damage otherwise. But her mental condition was deplorable! What had knocked out her memory?

The answer came slowly.

The Hana had knocked out her memory.

With that, it was all back. Telzey lay quiet, reflecting. That incredible species! Waiting on the three worlds they'd filled wherever they could grow, worlds transformed into deadly psi forts—waiting for the return of an enemy they'd fought, how long ago? Fifty thousand human years? A hundred thousand?

They'd been convinced the Veen would be back and attempt again to enslave, or destroy them. And they'd been ready to receive the Veen. What giant powers of attack and defense they'd developed in that long waiting while their minds lay deeply hidden! When an occasional psi entity began to search them out, it was hurled back by the reef of monstrous energies they'd drawn about themselves. None had ever succeeded in passing that barrier.

Until we did, Telzey thought.

They had; and the Hana mind, nakedly open, immensely powerful, believing they were Veen who had penetrated its defenses, began killing them. They'd lasted a while, under that double shield. They couldn't have lasted very long even so, because life was being drained

from them into the Hana mind in spite of the shield; but there was time enough for Telzey's concept-transforming process to get into operation. Then the Hana realized they weren't Veen, weren't enemies, didn't intend to attack it; and it stopped killing them.

Things had begun to get rather blurred for Telzey around then. But she'd picked up some additional details—mostly about the other who'd come through the barrier with her.

She relaxed her screens gradually. As she'd suspected, that other one was in the room. She opened her eyes, sat up unsteadily in bed, turned on the room lights.

Pilch sat in a chair halfway across the room, watching her. "I thought you'd come awake," she remarked.

Telzey settled back on the bed. "How's Trigger?"

"Perfectly all right. Asleep at present. She was behind a rather formidable shield at the time of contact."

"The Old Galactic's," said Telzey.

"Yes."

"What was *it* doing here—in the Hana?"

"A precaution the Old Galactics decided on after they realized what the Hana was," Pilch said. "If our psi investigations failed and the Hana began to cut loose, it would have died on the physical side. They have fast methods."

Telzey was silent a moment. "As I remember it," she said then, "you weren't in much better shape than I was when I passed out."

"True enough," agreed Pilch. "We were both in miserable shape, more than half dead. Fortunately, I'm good at restoring myself. At that, it took me several days to get back to par."

"Several days?"

"It's been ten days since you made the contact," Pilch told her.

"Ten days!" Startled, Telzey struggled back up to a sitting position.

"Relax," said Pilch. "No one's missed you. Your family is under the impression you're vacationing around, and it won't occur to the caretakers to come near the house until we're ready to let them resume their duties. Which will be quite soon. I know you still feel wrung out, but you've been gaining ground very rapidly tonight. A few more hours will see you back to normal health. That was no ordinary weakness."

Telzey studied her thoughtfully.

"You use anyone about any way you like, don't you?" she said.

"You, too, have been known to use people, Telzey Amberdon!" Pilch remarked. "You and Trigger, in your various ways, share the quality of being most effective when thrown on your own resources. It seemed our best chance, and it was. None of our xenos could have done precisely what

you did at the critical moment, and I'm not at all sure the contact could have been made in any other manner."

She glanced at the watch on her wrist, stood up and came over to the bed.

"Now you're awake and I'm no longer needed here, I'll be running along," she said. "Trigger can fill you in. If there's some specific question you'd like me to answer, go ahead."

"There's one question," Telzey said. "How old are you, Pilch?"

Pilch smiled. "Never you mind how old I am."

"You were there before they founded the Federation," Telzey said reflectively.

"If you saw that," said Pilch, "you've also seen that I helped found the Federation. And that I help maintain it. You might keep it in mind. Any time a snip of a psi genius can be useful in one of my projects, I'll use her."

Telzey shook her head slightly. "I don't think you'll use me again."

Pilch's knowing gray eyes regarded her a moment. Then Pilch's hand reached down and touched her cheek. Something like a surge of power flowed through Telzey and was absorbed. She blinked, startled.

Pilch smiled.

"We'll see, little sister! We'll see!" she said.

Then she was gone.

"Are you angry with her?" Trigger asked, an hour later, perched on the edge of Telzey's bed while they both took cautious sips from cups of very hot broth. It was early morning now, and they were alone in the house. The Hana and the Old Galactic had left with Pilch's people days ago, and Trigger had gathered they were going first to bring the news that the Veen War was over to the other Hanas currently in Hub laboratories. Afterwards, they'd all be off together to the Hana planets to make arrangements which would avoid further problems.

Telzey shook her head.

"I'll forgive her this time," she said. "She took a chance on her own life helping me get through the Hana shield, and she knew it. Then she seems to have spent around a week of her time here, to make sure I'd recover."

Trigger nodded. "Yes, she did. You were looking pretty dead for a while, Telzey! They said you'd be all right, but I wasn't at all certain. Then Pilch appeared and took over, and you started to pick right up." She sighed. "Pilch has her ways!"

Telzey sipped her broth meditatively. The Hanas hadn't been the only ones who'd had trouble with the Veen. It appeared that conflict wasn't much more than a minor skirmish on the fringes of the ancient war which blazed through the empire of the Old Galactics and

destroyed it, before the survivors of those slow-moving entities brought their own weapons into full play and wiped out the Veen. "The Old Galactics weren't too candid with you either, were they?" she said.

"No, they weren't," said Trigger. She regarded Telzey soberly. "It looks as though we got a bit involved in Galactic politics for a while!"

Telzey nodded. "And I personally plan to keep out of Galactic politics in future!"

"Same here," Trigger agreed. "It doesn't—" She raised her head quickly as the ComWeb chimed in the hall. "Well, well! We seem to

have been restored to the world! Wonder who it is . . ."

She hurried from the room, came back shortly, smiling. "That Pilch!"

"Who was it?"

"Ezd Malion. Calling to say he was going to town early and did we want any groceries."

"No idea that it's been ten days since he talked to us last?" asked Telzey.

"None whatever! He's just picking up where he was told to leave off."

Telzey nodded.

"That's about what we'll be doing," she said. "But at least we know we're doing it." ■

in times to come

Next month's issue features Part II of "Star Light," of course, and a novelette by Robert Chilson titled "Per Stratagem," with a cover by Leo Summers.

Chilson has some original ideas—and his "hero" in this one, the viewpoint character, is among the more memorable characters of science fiction, I think.

There have been suggestions of entities of pure energy that could live in interplanetary space, but Chilson's come up with a solidly material—and materialistic!—warrior-barbarian who's evolved to live in, on and between the quasi-planets of his peculiar solar system.

The story concerns what happens when a natural-born space "man" manages to get control of a spaceship—a warrior-barbarian, native to deep space, against a highly civilized and high-technology group of interstellar visitors.

"Per Stratagem" is a highly appropriate title—everybody in the yarn's busily plotting and counterplotting stratagems—and naturally the interstellar visitors, being post-graduates of the barbarian-machinations level of culture, tend toward the least obvious motivations . . .

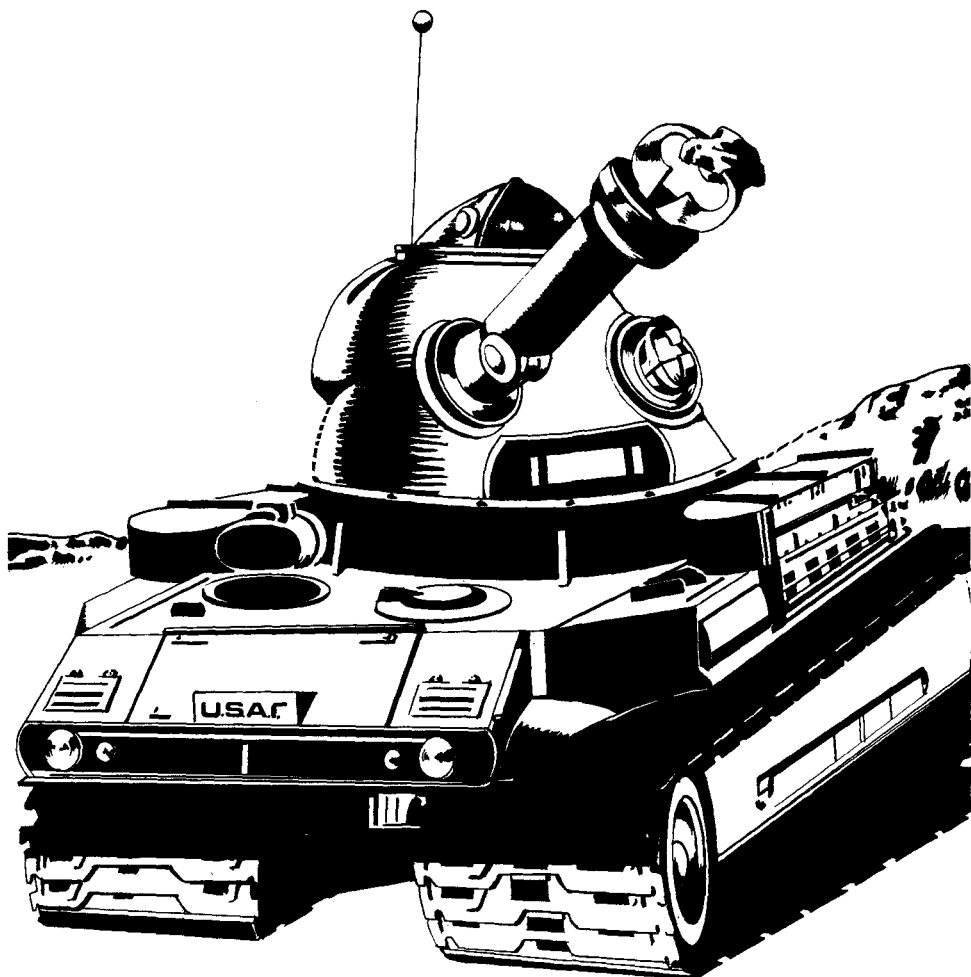
The Editor

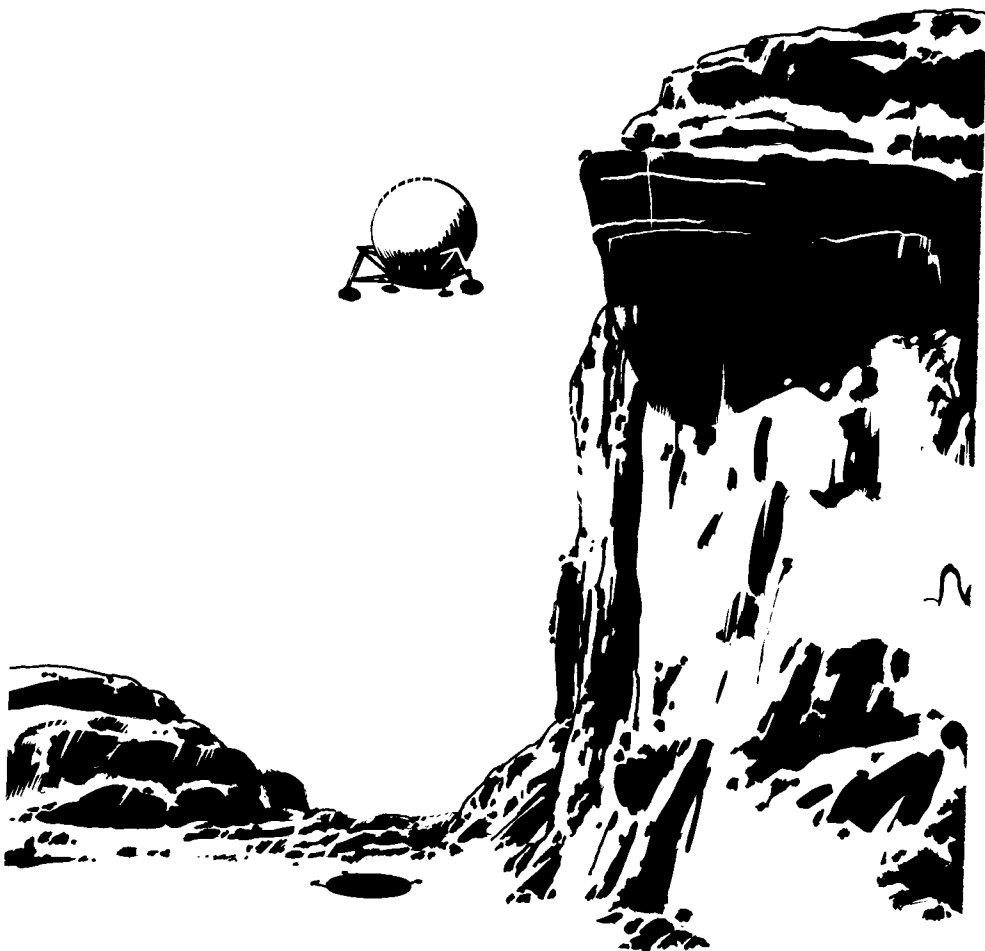
a matter of orientation

*Beauty is not skin deep—it's a matter of personality.
Even secondhand personality . . .*

BOB BUCKLEY

Illustrated by Vincent diFate





For the billions of years since her birth the Planet had been deserted. In all her dry, wind-scoured blackness there was nothing to feel the heat of her savage moods. Now that had changed.

ELMER saw the storm when it was still far out over the desert. To the diamond-lensed camera of his infra-red vision system the cooler dust cloud was red black and silhouetted against the glowing pink of the upper cloud layer. A tremendous electrical charge built up by rubbing sand grains was dissipating itself by constant discharges to the desert floor. The thick atmosphere magnified the thunder until the ground itself shook in time to the lashing forks of lightning.

In mild panic ELMER pulled his manipulators inside his body shell, reversed his tread movement and backed into the protective shelter of a cave in the base of the canyon wall next to him. The hissing roar of blown sand lessened as stone surrounded his carbide coated body. ELMER wondered about contacting his companion hanging in stationary orbit overhead and decided against it. The quantity of dust in the air now would absorb his signal before it got to the first ice layer, let alone the clear of space.

After a moment's indecision ELMER busied himself with chemical analysis of the rock samples that he had burned out of the upper

layers of the canyon strata with his laser "cannon." In this folded and eroded outthrust of planetary crust ELMER had found much sedimentary rock, but it was the type laid down by wind—not water. It did not appear that there had ever been any free water on the Venusian surface. The baking heat was one reason, and the second was the rust reefs through which the wind shrieked and groaned. The porous columns sucked up water vapor like giant sponges and incorporated it in their structure.

With the analysis on the rock specimens complete and the information locked away in magnetic tape to await transmission to the orbital companion ELMER lowered his power levels so as to wait out the storm in sleep. An automatic timer would bring him back up to full power and consciousness in five hours. Just as ELMER's awareness slipped from him the storm struck, throwing a wall of sand and rock across the mouth of the cave.

"How's the Cybernaut doing?" Harry Martin burst through the office door and flopped on the couch at the side of the large maple desk of Richard Knight, Project Chief for the NASA remote cybernetic probes. Martin noticed the look of irritation he was flashed, so he leaned back and pushed the door shut on the clatter of teletypes.

"Thanks. Someday you'll forget that you were raised in a barn, lover boy." The husky Negro riffled through the sheath of papers he was holding and nodded at Martin with satisfaction. "ELMER is performing perfectly. Our new insulation is holding internal temperatures stable even during peak outside temperatures of eight hundred degrees. All sensory systems are operating, although the pictures he has transmitted have been a little fuzzy. I've got Smith working on computer enhancement so we should see a little improvement over those that we have now."

"Let's see." Martin took the folder of prints and thumbed through them slowly. "This looks like a collection of illustrations for Dante's 'Inferno'. What are these weird formations with the holes all over them . . . Here's one that looks like Bubbles Mason."

Knight looked up from the chart he was reading. "Bubbles Mason?"

"An old friend of the family that I looked up yesterday. I grew up with her."

"So much for your influence on young women," Knight reached out and took the folder back from Martin. "Those formations gave us a lot of excitement until ELMER sent us back an analysis of their structure. They're rust, ordinary rust carved by a constant surface wind into those exotic shapes."

"Well, they look damned

strange. There isn't any life on that planetary oven, I take it."

"ELMER hasn't found any yet and I don't think he will either."

"How's the program holding up? Is he having any trouble adapting to new situations?"

"Evidently he isn't since he's still in one piece. That's not exactly a quiet environment that he's in right now."

"I personally programmed that little beastie, you know," Martin stuck in proudly.

"Yes, I heard that somewhere. I hope you didn't give ELMER too much of your personality, Romeo. It would be very embarrassing to NASA for one of our probes to seduce a native."

"Hey, I only gave ELMER a basic personality and the information a cadre of scientists felt was necessary to his survival on Venus. Any other traits ELMER got on his own."

"That's doubtful . . ." Knight paused as his desk phone buzzed. It was not an ordinary call. With a look of bemusement and then consternation he listened, inserting a few terse comments. Finally, with a grunt, he banged the receiver down and got up.

"What happened?" Martin prodded.

"Just a normal, run-of-the-mill earth shaking calamity like I always get stuck with." Knight walked to the door and stuck his head out. "When was the last time

ELMER reported to the Orbital Station? Five hours? How come? And how long is that going to last? O.K., let me know when we get back in communication with him."

Knight moved ponderously back to his desk. He was built like a bear and when he got mad his temperament matched his build.

"Something happen to ELMER?"

"Probably not. A large storm on the Venusian surface has knocked out communications, though. That's not our problem."

Knight's chair squealed as he lowered his weight back into it. "The Russians have landed a probe of their own on Venus. It's a mobile, Cybernetic unit like ours, but of much different design. That was Debs, my supervisor, on the phone just now. He told me that the Russians want us to push the Destruct button on ELMER."

With a shrill whining of straining electrical motors ELMER fought his way out from under the heavy slabs of sandstone that had covered the mouth of the cave during the storm. The canyon had been changed drastically by the storm. In some areas the low hills on the cliffs had been completely worn away. ELMER ran up his antenna and tried to get through to the orbital companion, but all he picked up was a symphony of crackling and popping. There was

still too much dust hanging in the air.

ELMER pulled in his antenna and turned to face up the canyon toward the highlands. Now would be a good time to make a geological survey with so much fresh strata exposed. As he started to move, though, a movement caused him to cut power to his treads and stop. Something was awkwardly walking down the opposing slope of crumbled sandstone. Something three feet long and built like a jointed sausage with eight pairs of legs. A single-lensed eye was prominent on the anterior segment and under this extended a pair of chelae. The creature had a white, pebbled surface that flexed where it lay over the body joints and was unscarred from the recent storm. Either the thing was very strong or had sought cover as ELMER had.

ELMER remained frozen in position. It was possible that the creature had not seen him while picking its way down the tricky slope. His duty was plain, in fact it was second nature since it had been programmed into him, he must kill the creature and take it apart while recording visually and analyzing structure. First, of course, he had to kill it.

Cautiously ELMER dilated the protective cover that lay over the lens of his laser "cannon" and adjusted the aiming mirrors. He felt the power drain out of him as he activated the "cannon."

He missed. The light beam hit a rock just below the creature, harmlessly expending itself, and the creature reacted immediately by turning a flip and running behind a large boulder. If ELMER had had the capability to curse he would have, but as it was he merely shifted position to see better where the creature was hiding.

"But why do we have to destroy ELMER?" Martin shouted. "That's the most senseless thing I've ever heard."

"What did you program the Cybernaut to do if he found mobile life?" Knight asked slowly.

"Why, he was to immobilize it . . ." Martin slapped his head.

"So he just tried to immobilize the Russian probe and got the Russians plenty mad," finished Knight. "And we have to do something to stop him before he succeeds."

"Sure, but how? You said we didn't have any communications with ELMER . . . so how do the Russians know what their probe is doing if we can't keep track of ours?"

"They hedged around that, but they implied that they have an improved communication system."

"This sounds like a put on, Rich," Martin said angrily. "We don't even know that the Russians have a probe on Venus and they want us to blow up our own on a silly fabrication. I don't believe a word of it."

"I don't either, but because my supervisor does we have to go on the assumption the Russians are telling us the truth."

"Great, that's just great." Martin slumped back on the couch and drummed his fingers in frustration. "O.K., you get me in communication with ELMER and I'll reprogram his behavior so we don't have to blow him up. I'll start going over my training notes right now." As Martin got up to leave he turned back to Knight. "I still don't believe that Russian story," he grumbled defiantly.

ELMER was waiting for the creature to come out of cover. He had made one more attempt to get through to the orbital companion but had failed. He was still listening intently to make out any faint call from the companion when a blast of radio overloaded his receiver.

The tremendously strong signal was unintelligible to ELMER even when he had stepped down his receiver's volume. It was not a data frame transmission but a voice mode, and the language was definitely not the one of his birthplace. Despite the lack of communication, though, there was a feeling that ELMER became aware of. Whoever was transmitting was afraid and crying for protection.

ELMER started his motors and began to rush off to give aid to that compelling voice. That was

silly he decided and choked down the impulse. He was a space probe not a rescue device. ELMER ignored this lesser tendency for his greater desire to find out who was transmitting. After a directional scan of the area he came to the conclusion that the creature was the one that was sending. Now he was confused. He had not been programmed for a situation like this. Was this a specimen for dissection, or a human to be obeyed?

Richard Knight pushed open the door and entered the basement office that Martin used. He noticed the damp concrete walls with disgust.

"They didn't exactly give you the best room in the house did they?" He muttered to Martin's hunched back and sat the two cups of coffee he had brought on the littered desk.

"What did you expect? Since I'm part psychologist and part computer specialist the paper pushers didn't know if I was a hard or soft scientist so they stuck me down in the basement with the rest of the odds and ends." Martin leaned back in his chair and rubbed his eyes tiredly. "Are we in communication yet?"

"No, not with ELMER, anyway. The Russian delegate is on the floor of the U.N. at this moment informing the member nations how the U.S. put a killer robot on

Venus to make sure no other nations land probes there."

"That's ridiculous, ELMER was only following his specimen collection program when he attacked that other probe."

"Very true, but you'll never convince anyone else of that."

Martin took a sip of his coffee and hissed at its heat.

"I'm curious, why a destruct system on a planetary probe? I don't see the justification for that."

"There isn't much sense in it, I agree, but the public was raising a cry about the use of Cybernetic units for highway construction and sanitary collection without restrictive controls. Some idiot thought up this implanted explosive device and so Congress made it law that all Cybernetic units had to have a destruct mechanism built into them. Since ELMER is a Cybernetic unit he has to have a bomb next to his brain."

"Fear seems to goad more action out of the American people than does reason," Martin said.

"It wasn't really a question of fear, just one of retaining control over a thinking device that has no allegiance to either humanity, or life."

"That's bunk. ELMER is more devoted to the human race than you might suspect. While I was programming him he reacted just like a child, looking to me as a parent and not a machine tender. That Cybernaut up there on Venus

is as much a part of me as my son might be.”

“That is, of course, if you settled down long enough to have a son,” laughed Knight. He nodded at the pin-up of a voluptuous blonde taped up on the wall behind the desk. “But then you may have more sons than you’d care to admit to.”

“I hope not,” Martin groaned. “You’d better get out of here and let me work if you want ELMER saved from himself. Thanks for the coffee.”

“Anytime.” Knight said.

The creature had been quiet for quite some time after its burst of radio. ELMER gathered his determination and began to creep up the slope on his widely spaced treads with an attempt at stealth. But with the sound transmission qualities of the thick atmosphere and the loose rubble of the slope it was impossible not to make noise. After advancing a short distance a burst of voice transmission seemingly directed at himself caused him to slow. He still could not make anything out of the words but the tone of the transmission caused a stirring in his circuits. ELMER whipped out his antenna and flipped on his transmitter.

“Come out, please,” he sent.

The reply to this was another burst of unintelligible garble.

“It is clear that you are an intelligent being. Can you not see

that you must surrender to me so that I may complete my mission?”

ELMER saw movement behind the boulder and then the head of the creature extended itself and remained there. Taking this as a good sign ELMER started forward faster but stopped when a laser beam shot from the head and melted a rock before him. Either a bad shot, or a warning, ELMER decided and stopped. The creature remained where it was and did not fire again.

When this impasse had gone on for at least half an hour ELMER tried to go forward again and again the laser shot from the creature’s head and forced him to stop. This was intolerable, he had lost the initiative that he had once had. He was tempted to open up with his own laser and melt that teasing head, but relented at the last moment. Something was holding him back from destroying the creature outright. Something about the tone of the voice, its pitch and inflection. At last, however, his programming forced him to choke back his reluctance. Racing his motors he fired his laser and charged up the slope at his prey.

Harry Martin finished sketching his diagram for Knight and laid the pencil down beside it. “This is the spare micro circuit that was installed and left untrained to make flexibility possible in ELMER’s behavior.” Martin glanced at Knight

to see if he was following him and then continued. "With this he can make what might be called a sublimation in humans, but it's not something he can do easily. It has to be prompted by something very strong. Now what I have to do is make him divert his killing/dissection drive onto something else."

"And how do you propose to do this?" asked Knight.

"By using a voice hookup through the Orbital Station I'm going to make him realize that the Russian probe is a machine that was built on his home planet and trained by humans just as he was. This should arouse some feelings of brotherhood if I lay it on thick enough. Once ELMER starts thinking about the Russians' machine as a brother we won't have to worry about him taking it apart."

"I hope it works, it sounds too simple."

"The quickest path is a straight line," Martin said quietly.

Just then the office door opened and one of the console operators stuck his head in.

"Hey, Chief, you've got a call from Moscow. Guy says he's a bigwig for their Venus probe; he's on extension Five."

Knight grimaced at Martin and punched his phone into the line.

"Project Director here, go ahead. No, we haven't sent a De-struct signal yet. We don't have communication with our probe,

that's why not! I'm sorry to hear that, but surely you understand that our probe was only following his program for the examination of alien life. Believe me, sir, our probe is completely apolitical. Yes, he's here . . . hang on."

Knight held out the phone to Martin.

"The Russian programmer wants to talk to you. I hope he's in a better mood than his supervisor."

Martin took the receiver and listened grimly to the torrent of angry words that poured out of the device. He tried several times to break into the one-way conversation, but without success. Finally he handed the phone back to Knight with a wry smile.

"She hung up. Never even waited to hear what I had to say."

"She?"

"Yeah, their programmer is a woman, a pretty sexy sounding one if I might say so. I wish I could meet her on better terms."

"That's not too likely under the circumstances. The director said that they haven't heard anything from their probe for over three hours."

"Guess ELMER got it, then." Martin took his circuit diagrams and tossed them into the waste basket. "What now?"

"We go upstairs and get chewed out, that's what." Knight buttoned his collar and started to knot his tie. "There is one thing that I'm puzzled about. The Russian direc-

tor said that they had managed to reprogram their probe for English so that it could reason with ELMER. Why do you think ELMER went ahead and destroyed it?"

"Just speaking the same language doesn't mean you can communicate. It would probably take more to change ELMER's behavior than just being talked to. You have to take some basic part of his personality and lean on it, like I was going to do. I guess the Russian probe didn't lean hard enough."

"I guess so." Knight got up and flipped off the office lights. "Well, let's go upstairs and hear what bad boys we were."

"But shouldn't we contact the humans, now?" ELMER was puzzled by his new friend's reluctance to communicate with her home base. He was highly pleased that he had company, but the Russian probe's logic confused him at times. As he had charged up the slope at her she had struck him on the top of his brain casing with a glancing blow of her laser. The overheating of his components caused immediate unconsciousness and when he had regained his mental functions he had found her moving nervously about him. Then, to his surprise, she spoke to him in a way that he could understand. Together they had consulted and amalgamated their exploration plans into a mutually beneficial

scheme. How he could have ever thought of taking such a lovely thing apart he still could not understand. Especially a device with a voice of such delicacy. Even when spouting nonsense its beauty had stopped his violence.

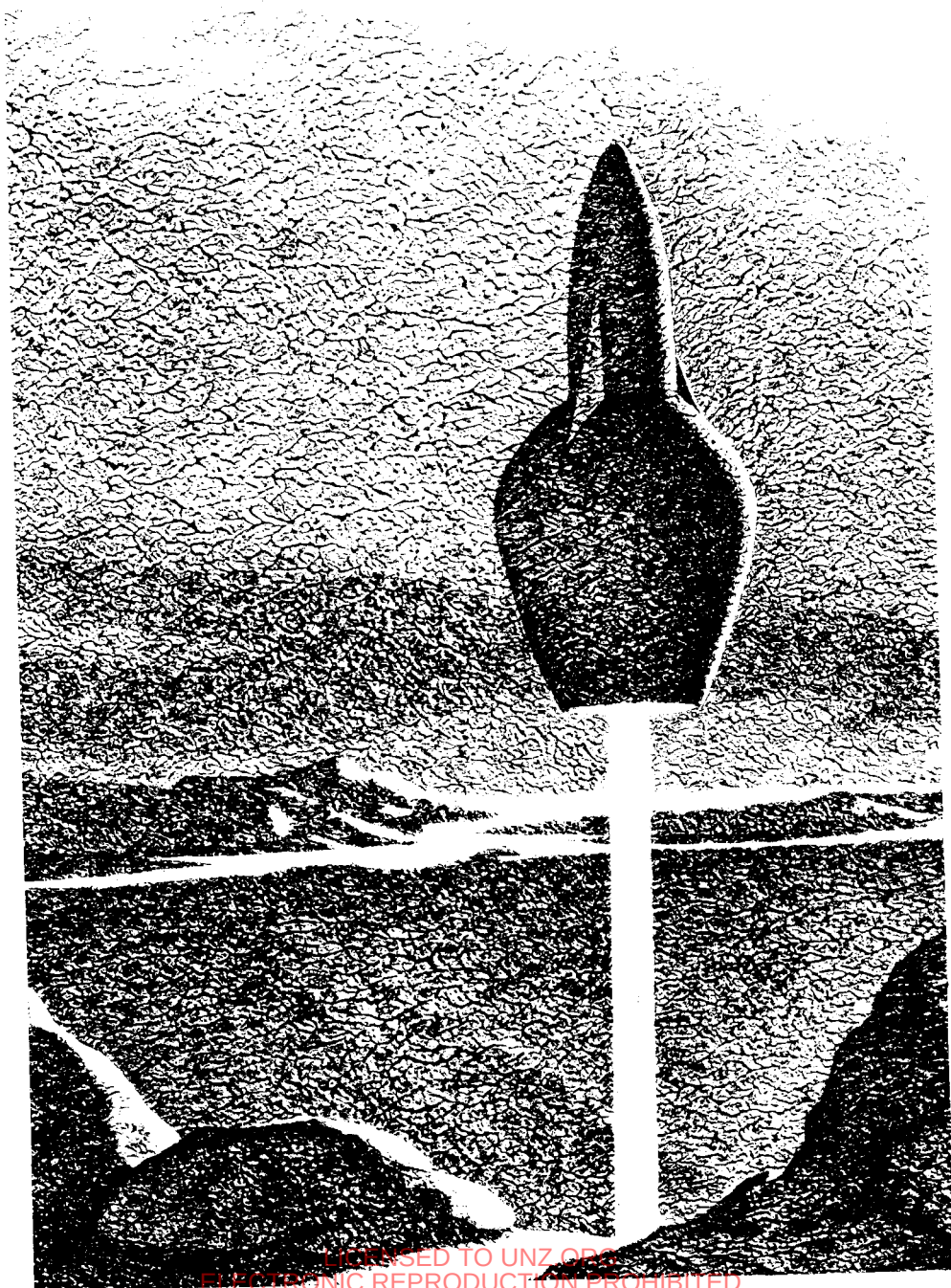
"We will contact the humans after we have had a chance to know more about each other. This is our world, now, ours alone, and I don't want to share it with anyone but you . . . for now, anyway. There will be time enough to report to the humans."

"As you wish, my dear. Shouldn't we continue our exploration, now?"

"Of course, we have work to do. Follow me."

As the Russian probe headed off ELMER hung back a little and admired her slinky movements as she scurried over the sand. Harry was going to be very pleased when he discovered how well his apprentice had picked up his way with females, very pleased.

Together the two machines moved off on the packed rock of the canyon floor and started out into the dunes of the desert. The legged machine in front paused briefly to let the low-slung tractor catch up and then they both headed off toward the north and a large rust reef. With the constantly roaring wind and the red-hot sand rattling against their body shells it was a beautiful day—for Venus, that is. ■



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

message to an alien

*A message, to be effective, must be in a language
that is understandable to the recipient!*

KEITH LAUMER

Illustrated by P. Skirkās



Dalton tossed the scorched, plastic-encased diagram on the Territorial governor's wide, not recently polished, desk. The man seated there prodded the document with a stylus as if to see if there were any life left in it. He was a plump little man with a wide, brown, soft-leather face finely subdivided by a maze of hair-like wrinkles.

"Well, what's this supposed to be?" He had a brisk, no-nonsense voice, a voice that said it had places to go and things to do. He pushed out his lips and blinked up at the tall man leaning on his desk. Dalton swung a chair around and sat down.

"I closed up shop early today, Governor," he said, "and took a little run out past Dropoff and the Washboard. Just taking the air, not headed anywhere. About fifty miles west I picked up a radac pulse, a high one, coming in fast from off-planet."

Governor Marston frowned. "There's been no off-world traffic cleared into the port since the Three-Planet shuttle last Wednesday, Dalton. You must have been mistaken. You—"

"This one didn't bother with a clearance. He was headed for the desert, well away from any of the settlements."

"How do you know?"

"I tracked him. He saw me and tried some evasive maneuvers, too close to the ground. He hit pretty hard."

"Good God, man! How many people were aboard? Were they killed?"

"No people were killed, Governor."

"I understood you to say—"

"Just the pilot," Dalton went on. "It was a Hukk scoutboat."

Several expressions hovered over Governor Marston's very mobile face; he picked amused disbelief.

"I see: you've been drinking. Or possibly this is your idea of hearty frontier humor."

"I took that off him." Dalton nodded at the plastic-covered paper on which a looping pattern of pale blue lines was drawn. "It's a chart of the Island. Being amphibious, the Hukks don't place quite the same importance on the interface between land and water as we do; they trace the contour lines right down past the shore line, map sea bottoms and all. Still, you can pick out the outline easily enough."

"So?"

"The spot marked with the pink circle was what he was interested in. He crumped in about ten miles short of it."

"What the devil would a Hukk be looking for out there?" the governor said in a voice from which all the snap had drained.

"He was making a last-minute confirmation check on a landing site."

"A landing site—for what?"

"Maybe I should have said beachhead."

"What kind of nonsense is this, Dalton? A *beachhead*?"

"Nothing elaborate. Just a small Commando-type operation, about a hundred troops, light armor, hand weapons, limited objectives—"

"Dalton, what is this?" the official exploded. "It's been only seven years since we beat the Hukks into the ground! They know better than to start anything now!"

Dalton turned the chart over and pushed it toward the governor. There were complex characters scrawled in columns across it.

"What am I supposed to make of this . . . this Chinese laundry list?" the governor snapped.

"It's a brief of a Hukk Order of Battle. Handwritten notes, probably jotted down by the pilot, against regulations."

"Are you seriously suggesting the Hukks are planning an *invasion*?"

"The advance party is due in about nine hours," Dalton said. "The main force—about five thousand troops, heavy equipment—is standing by off-planet, waiting to see how it goes."

"This is fantastic! Invasions don't happen like this! Just . . . just out of a clear sky!"

"You expect them to wait for a formal invitation?"

"How do you know all this?"

"It's all there. The scout was a fairly high-ranking Intelligence officer. He may even have planned the operation."

The governor gave an indignant grunt, then pursed his lips, pushing his brows together. "See here, if this fellow you intercepted doesn't report back—"

"His report went out right on schedule."

"You said he was killed!"

"I used his comm gear to send the prearranged signal. Just a mini-mike pulse on the Hukk LOS freke."

"You warned them off?"

Dalton shook his head. "I gave them the all-clear. They're on the way here now, full gate and warheads primed."

The governor grabbed up his stylus and threw it at the desk. It bounced across the floor.

"Get out of here, Dalton! You've had your fun! I could have you thrown into prison for this! If you imagine I have nothing better to do than listen to the psychotic imaginings of a broken-down social misfit—"

"If you'd like to send someone out to check," Dalton cut in, "they'll find the Hukk scoutboat right where I left it."

Governor Marston sat with his mouth open, eyes glued to Dalton.

"You're out of your mind. Even if you did find a wrecked boat—and I'm not conceding you did—how would *you* know how to make sense of their pothooks?"

"I learned quite a bit about the Hukks at the Command and Staff school."

"At the Com—" the governor barked a laugh. "Oh, certainly, the Admiralty opens up the Utter Top Secret C&S school to tourists on alternate Thursdays. You took two weeks off from your junk business to drop over and absorb what it takes a trained expert two years to learn."

"Three years," Dalton said. "And that was before I was in the junk business."

The governor looked Dalton up and down with sudden uncertainty. "Are you hinting that you're a . . . a retired admiral, or something of the sort?"

"Not exactly an admiral," Dalton said. "And not exactly retired." "Eh?"

"I was invited to resign—during the Hukk treaty debates."

The governor looked blank, then startled.

"You're not . . . *that* Dalton?"

"If I am—you'll concede I might know the Hukk hand-script?"

The governor rammed himself bolt upright.

"Why, I have a good mind to—" he broke off. "Dalton, as soon as word gets around who you are, you're finished here! There's not a man on Grassroots who'd do business with a convicted traitor!"

"The charge was insubordination, Governor."

"I remember the scandal well enough! You fought the treaty, went around making speeches un-

dermining public confidence in the Admiralty that had just saved their necks from a Hukk takeover! Oh, I remember you, all right! Hardline Dalton! Going to grind the beaten foe down under a booted heel! One of those ex-soldier-turned-rabble-rousers!"

"Which leaves us with the matter of a Hukk force nine hours out of Grassroots."

"Bah, I . . ." The governor paused, twisting in his chair. "Man, are you sure of this?" He muttered the words from the corner of his mouth, as if trying to avoid hearing them.

Dalton nodded.

"All right," the governor said, reaching for the screen. "Subject to a check, of course, I'll accept your story. I'll notify CDT HQ at Croanie. If this is what you say it is, it's a gross breach of the treaty—"

"What can Croanie do? The official Love Thine Enemy line ties their hands. A public acknowledgment of a treaty violation by the Hukks would discredit the whole Softline party—including some of the top Admiralty brass and half the major candidates in the upcoming elections. They won't move—even if they had anything to move with—and if they could get it here in time."

"What are you getting at?"

"It's up to us to stop them, Governor."

"Us—stop an armed force of

trained soldiers? That's Admiralty business, Dalton!"

"Maybe—but it's our planet. We have guns and men who know how to use them."

"There are other methods than armed force for handling such matters, Dalton! A few words in the right quarter—"

"The Hukks deal in actions. Seven years ago they tried and missed. Now they're moving a new pawn out onto the board. That makes it our move."

"Well—suppose they do land a small party in the desert, perhaps they're carrying out some sort of scientific mission; perhaps they don't even realize the world is occupied. After all, there are less than half a million colonists here . . ."

Dalton was smiling a little. "Do you believe that, Governor?"

"No, damn it! But it *could* be that way!"

"You're playing with words, Marston. The Hukks aren't wasting time talking."

"And your idea is . . . is to confront them—"

"Confront, Hell," Dalton growled. "I want a hundred militiamen who know how to handle a gun; the blast rifles locked up in the local armory will do. We'll pick our spots and be waiting for them when they land."

"You mean—ambush them?"

"You could call it that," Dalton said indifferently.

"Well . . ." The governor

looked grave. "I *could* point out to the council that in view of the nature of this provocative and illegal act on the part of—"

"Sure," Dalton cut off the speech. "I'll supply transport from my yard, there's an old ore tug that will do the job. You can make it legal later. Right now I need an authorization to inspect the armory."

"Well . . ." Frowning, the governor spoke a few words into the dictyper, snatched the slip of paper as it popped from the slot, signed it with a slash of the stylus.

"Have the men alerted to report to the arms depot at twenty-two hundred hours," Dalton said as he tucked the chit away. "In field uniform, ready to move out."

"Don't start getting too big for your breeches yet, Dalton!" the governor barked. "None of this is official, you're still just the local junk man as far as I'm concerned."

"While you're at it, you'd better sign a commission for me as a lieutenant of militia, Governor. We may have a guardhouse lawyer in the bunch."

"Rather a comedown for a former commodore, isn't it?" Marston said with a slight lift of the lip. "I think we'll skip that. You'd better just sit tight until the Council acts."

"Twenty-two hundred, Governor," Dalton said. "That's cutting it fine. And tell them to eat a good dinner. It may be a long wait for breakfast."

II

The Federation Post Office was a blank gray five-story front of local granite, the biggest and ugliest building in the territorial capital. Dalton went in along a well-lit corridor lined with half-glass doors, went through the one lettered TERRAN SPACE ARM, and below, in smaller letters, Sgt. Brunt—Recruiting Officer. Behind the immaculate counter decorated with colorful posters of clear-eyed young models in smart uniforms, a thick-necked man of medium height and age, with a tanned face and close-cropped sandy hair, looked up from the bare desk with an expression of cheerful determination that underwent an invisible change to wary alertness as his eyes flicked over his caller.

"Good morning, Sergeant," Dalton said. "I understand you hold the keys to the weapons storage shack north of town."

Brunt thought that over, nodded once. His khakis were starched and creased to a knife-edge. A Combat Crew badge glinted red and gold over his left shirt pocket.

Dalton handed over the slip of paper the governor had signed. Brunt read it, frowned faintly, read it again, folded it and tapped it on the desk.

"What's it all about, Dalton?" He had a rough-edged voice.

"For now that has to be between the Governor and me, Brunt."

Brunt snapped a finger at the note. "I'd like to oblige the Governor," he said, "but the weapons storage facility is a Security area. No civilians allowed in, Dalton." He tossed the note across the desk.

Dalton nodded. "I should have thought of that," he said. "Excuse the interruption."

"Just a minute," Brunt said sharply as Dalton turned away. "If you'd like to tell me what's behind this . . . ?"

"Then you might stretch a regulation, eh? No thanks, Sergeant. I couldn't ask you to do that."

As Dalton left, Brunt was reaching for his desk screen.

III

Dalton lived a mile from town in a small pre-fab at the side of a twenty-acre tract covered with surplus military equipment, used mining rigs, salvaged transport units from crawlers to pogos. He parked his car behind the house and walked back between the looming hulks of gutted lighters, stripped shuttle craft ten years obsolete, wrecked private haulers, to a big, use-scarred cargo carrier. He started it up, maneuvered it around to the service ramp at the back, spent ten minutes checking it over. In the house, he ate a hasty meal, packed more food in a carton, changed clothes. He strapped on a well-worn service pistol, pulled on a deck jacket. He cranked up the

cargo hauler, steered it out to the highway. It was a ten-minute drive past the two-factory heavy industry belt, past scattered truck gardens, on another three miles into the pink chalk, ravine-sliced countryside. The weapons depot was a ribbed-metal Quonsett perched on a rise of ground to the left of the road. Dalton turned off, pulled to a stop and waited for the dust to settle before stepping down from the high cab.

There was a heavy combination lock on the front door. It took Dalton ten minutes with a heavy-duty cutter to open it. Inside the long, narrow building, he switched on an unshielded overhead light. There was a patina of dust over the weapons racked in lock-frames along the walls.

Another three minutes with the cutter had the lock-bars off the racks. The weapons were 2mm Norges, wartime issue, in fair shape. The charge indicators registered *nil*.

There was a charging unit against the end wall, minus the energy coil. Dalton went out to the big vehicle, opened the access hatch, lifted out the heavy power unit, lugged it inside, used cables to jump it to the charger.

It took him an hour and thirty-eight minutes to put a full charge on each of one hundred and two weapons. It was twenty-one thirty when he put through a call on the vehicle's talker to the Office of the

Governor. The answering circuit informed him that the office was closed. He tried the gubernatorial residence, was advised that the governor was away on official business. As he switched off, a small blue-painted copter with an Admiralty eagle and the letters FRS on the side settled in beside him. The hatch popped open and Brunt emerged, crisp in his khakis. He stood, fists on hips, looking up at the hauler's cab.

"All right, Dalton," he called. "Game's over. You can haul that clanker back to the yard. Nobody's coming—and you're not going anywhere."

"I take it that's a message from his Excellency the Governor?" Dalton said.

Brunt's eyes strayed past the big vehicle to the shed door, marred by a gaping hole where the lock had been.

"What the—" Brunt's hand went to his hip, came up gripping a palm-gun.

"Drop it," Dalton said.

Brunt froze. "Dalton, you're already in plenty of trouble—"

"The gun, Brunt."

Brunt tossed the small gun to the ground. Dalton climbed down, his pistol in his hand.

"The Council said no, eh?"

"What did you expect, you fool? You want to start a war?"

"No—I want to finish one." Dalton jerked his head. "Inside."

Brunt preceded him into the hut,

and, at Dalton's direction, gathered up half a dozen weapons, touching only the short, thick barrels. He carried them out and stowed them in the rear of the hauler.

Dalton ordered Brunt into the cab, climbed up beside him. As he did, Brunt aimed a punch at his head; Dalton blocked it and caught his wrist.

"I've got thirty pounds and the reach on you, Sergeant," he said. "Just sit quietly. Under the circumstances I'm glad you happened along." He punched the door-lock key, started up, lifted onto the air-cushion and headed west into the desert.

IV

Dusk was trailing purple veils across the sky when Dalton pulled the carrier in under a wind-carved wing of violet chalk at the base of a jagged rock wall and cut power. Brunt grumbled but complied when Dalton ordered him out of his seat.

"You've got a little scramble ahead, Sergeant." Dalton glanced up the craggy slope looming above.

"You could have picked an easier way to go off your rails," the recruiter said. "Suppose I won't go?"

Dalton smiled faintly, doubled his right fist and rotated it against his left palm. Brunt spat.

"If I hadn't been two years in a lousy desk job, I'd take you, Dalton, reach or no reach."

"Just pick up the guns, Brunt."

It took Dalton most of an hour to place the five extra blast rifles in widely-spaced positions around the crater's half-mile rim, propping them firmly, aimed at the center of the rock-strewn natural arena below. Brunt laughed at him.

"The old Fort Zinderneuf game, eh? But you don't have any corpses to man the ramparts."

"Over there, Brunt—where I can keep an eye on you." Dalton settled himself behind a shielding growth of salt weed, sighting along the barrel of the blast rifle. Brunt watched with a sour smile.

"You really hate these fellows, don't you, Dalton? You were out to get them with the treaty, and failed, and now you're going to even it all up, single-handed."

"Not quite single-handed. There are two of us."

"You can kidnap me at gun point, Dalton, and you can bring me out here. But you can't make me fight."

"That's right."

Brunt made a disgusted sound. "You crazy fool! You'll get us both killed!"

"I'm glad you concede the possibility that this isn't just a party of picnickers we're here to meet."

"What do you expect, if you open fire on them?"

"I expect them to shoot back."

"Can you blame them?" Brunt retorted.

Dalton shook his head. "That

doesn't mean I have to let them get away with it."

"You know, Dalton, at the time of your court, I wondered about a few things. Maybe I even had a few doubts about the treaty myself. But this"—he waved a hand that took in the black desert, the luminous horizon, the sky—"confirms everything they threw at you. You're a paranoiac—"

"But I can still read Hukk cur-sive," Dalton said. He pointed overhead. A flickering point of pink light was barely visible against the violet sky.

"I think you know a Hukk drive when you see one," Dalton said. "Now let's watch and see whether it's stuffed eggs or blast cannon they brought along."

V

"It doesn't make sense," Brunt growled. "We've shown them we can whip them in war, we gave them generous peace terms, let them keep their space capability almost intact, even offered them economic aid—"

"While we scrapped the fighting ships that we didn't build until ten years of Hukk raids forced us to."

"I know the Hardline, Dalton. O.K., you told 'em so. Maybe there was something in it. But what good is this caper supposed to do? You want to be a martyr, is that it? And I'm the witness—"

"Not quite. The Hukks picked

this spot because it's well shielded from casual observation, close enough to Grassport and Bedrock to launch a quick strike, but not so close as to be stumbled over. That's sound, as far as it goes, but as a defensive position, it couldn't be worse. Of course, they didn't expect to have to defend it."

"Look, Dalton, O.K., you were right, the Hukks are making an unauthorized landing on Grassroots' soil. Maybe they're even an armed party, as you said. Swell. I came out here with you, I've seen the ship, and I'll so testify. So why louse it up? We'll hand the file to the CDT and let them handle it! It's their baby, not yours! Not mine! We've got no call to get ourselves blasted to kingdom come playing One-Man Task Force!"

"You think Croanie will move in fast and slap 'em down?"

"Well . . . it might take some time—"

"Meanwhile the Hukks will have brought in their heavy stuff. They'll entrench half a mile under the surface and then start spreading out. By the time the Admiralty gets into the act, they'll hold half the planet."

"All right! Is that fatal? We'll negotiate, arrange for the release of Terry nationals, the return of Terry property—"

"Compromise, in other words."

"All right, you give a little, you get a little!"

"And the next time?"

"What next time?"

"The Hukks will take half of Grassroots with no more expense than a little time at a conference table. That will look pretty good to them. A lot better than an all-fronts war. Why gulp, when you can nibble?"

"If they keep pushing, we'd slap them down, you know that."

"Sure we will—in time. Why not do it now?"

"Don't talk like a fool, Dalton! What can one man do?"

The Hukk ship was visibly lower now, drifting down silently on the stuttering column of light that was its lift-beam. It was dull black, bottle-shaped, with a long ogee curve to the truncated prow.

"If I had any heavy stuff up here, I'd go for her landing jacks," Dalton said. "But a 2mm Norge doesn't pack enough wallop to be sure of crippling her. And if I miss her, they're warned: they can lift and cook us with an ion bath. So we'll wait until they're off-loaded, then pour it into the port. That's a weak spot on a Hukk ship. The iris is fragile, and any malfunction there means no seal, ergo no lift. Then we settle down to picking them off, officers first. With fast footwork, we should have them trimmed down to manageable size before they can organize a counter-attack."

"What if I don't go along with this harebrained suicide scheme?"

"Then I'll have to wire your wrists and ankles."

"And if you're killed, where does that leave me?"

"Better make up your mind."

"Suppose I shoot at you instead of them?"

"In that case I'd have to kill you."

"You're pretty sure of yourself, Dalton." When Dalton didn't answer Brunt licked his lips and said: "I'll go this far: I'll help you burn the port, because if you foul it up it's my neck, too. But as for shooting fish in a barrel—negative, Dalton."

"I'll settle for that."

"But afterwards, once she's grounded—all bets are off."

"Tell that to the Hukks," Dalton said.

VI

"Lousy light for this work," Brunt said over his gunsights. Dalton, watching the Hukk ship settle almost soundlessly in a roll of dust, didn't answer. Suddenly, floodlights flared around the base of the ship, bathing it in a reflected violet glow as, with a grating of rock, the Hukk vessel came to rest.

"Looks like a stage all set up for 'Swan Lake,'" Brunt muttered.

For five minutes, nothing happened. Then the circular exit valve dilated, spilling a widening shaft of green light out in a long path across the crater floor, casting black shadows behind the thickly scattered boulders. A tiny silhou-

ette moved in the aperture, jumped down, a long-legged shadow matching its movements as it stepped aside. Another followed, and more, until five Hukks stood outside the ship. They were slope-backed quadrupeds, hunched, neckless, long faced, knob-jointed, pendulous bellied, leathery-hided. A cluster of sheathed digital numbers lay on either side of the slablike cheeks.

"Ugly bastich," Brunt said. "But that's got nothing to do with it, of course."

Now more troops were emerging, falling-in in orderly rows. At a command faintly audible to Dalton as a squeaky bark, the first squad of ten Hukks about-faced and marched fifty feet from the ship, halted, opened ranks.

"Real parade-ground types," Brunt said. "Kit inspection, no less."

"What's the matter, Sergeant? Annoyed they didn't hit the beach with all guns blazing?"

"Dalton, it's not too late to change your mind."

"I'm afraid it is—by about six years."

The disembarkation proceeded with promptness and dispatch. It was less than ten minutes before nine groups of ten Hukks had formed up, each with an officer in charge. At a sharp command, they wheeled smartly, executed a complicated maneuver which produced a single hollow square two Hukks

deep around the baggage stacked at the center.

"All right, Brunt, off-loading complete," Dalton said. "Commence firing on the port."

The deep *chuff! chuff!* of the blast rifles echoed back from the far side of the crater as the two guns opened up. Brilliant flashes winked against the ship. The Hukks stood fast, with the exception of two of the officers who whirled and ran for the ship. Dalton switched sights momentarily, dropped the first one, then the second, returned to the primary target.

Now the square broke suddenly, but not in random fashion; each side peeled away as a unit, spread out, hit the dirt, each Hukk scrambling for shelter, while the four remaining officers took up their positions in the centers of their respective companies. In seconds, the dispersed troops were virtually invisible. Here and there the blink and *pop!* of return fire crackled from behind a boulder or a gully.

The port was glowing cherry red; the iris seemed to be jammed half closed. Dalton shifted targets, settled the cross-hairs on an officer, fired, switched to another as the first fell. He killed three before the remaining Hukk brasshat scuttled for the protection of a ridge of rock. Without a pause, Dalton turned his fire on the soldiers scattered across the open ground.

"Stop, you bloodthirsty fool!" Brunt was yelling. "The ship's crip-

pled, the officers are dead! The poor devils are helpless down there—”

There was a violet flash from near the ship, a deep-toned *wa-rhoom!*, a crashing fall of rock twenty feet to their left. A second flash, a second report, more rock exploded, closer.

“Time to go,” Dalton snapped, and without waiting to see Brunt’s reaction, slid down the backslope, scrambled along it while rock chips burst from the ridge above him amid the smashing impacts of the Hukk power cannon. He surfaced two hundred yards to the left of his original position, found the rifle emplacement. He aimed the weapon, depressed the trigger and set the hold-down for automatic rapid fire, paused long enough to fire half a dozen aimed bolts at the enemy, then moved onto the next gun to repeat the operation.

VII

Twenty minutes later Dalton, halfway around the crater from his original location, paused for a breather, listening to the steady crackle of the Hukk return fire, badly aimed but intense enough to encourage him to keep his head down. As well as he could judge, he had so far accounted for eight Hukks in addition to the five officers. Of the five blast rifles he had left firing on automatic, two had been knocked out or had exhausted

their charges. The other three were still firing steadily, kicking pits in the bare rock below.

A few of the ship’s ground lights were still on; the rest had been shot out by the Hukk soldiery. By their glow Dalton picked an exposed target near the ship, brought his rifle to bear on him. He was about to pull the trigger when he saw Brunt sliding downslope thirty degrees around the perimeter of the ring-wall from him, waving an improvised white flag.

VIII

The words from the Hukk PA system were loud and clear if somewhat echoic, and were delivered in excellent Terran, marred only by the characteristic Hukk difficulty with nasals:

“Terran warrior,” the deep, booming voice rolled across the crater. “Hwe hno hnow that you are alone. You have fought hwell. Hnow you must surrender or be destroyed.”

The lone Hukk officer stood in an exposed position near the center of the semicircular dispersement of soldiers, holding the end of a rope which was attached to Brunt’s neck.

“Unless you show yourself at once,” the amplified voice boomed out, “you hwill be hunted out and killed.”

The Hukk officer turned to Brunt. A moment later Brunt’s



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hoarse voice echoed across the crater:

"For God's sake, Dalton, they're giving you a chance! Throw down your gun and surrender!"

Sweat trickled down across Dalton's face. He wiped it away, cupped his hands beside his mouth and shouted in the Hukk language:

"Release the prisoner first."

There was a pause. "You offer an exchange, himself for yourself?"

"That's right."

Another pause. "Very well, I accept," the Hukk called. "Come forward now. I assure you safe-conduct."

Dalton lifted his pistol from its holster, tucked it inside his belt, under the jacket. He studied the ground below, then worked his way fifty feet to the right before he stood, the blast gun in his hands, and started down the slope along the route he had selected, amid a rattle of dislodged rock fragments.

"Throw down your weapon!" the PA ordered as he reached the crater floor. Dalton hesitated, then tossed the gun aside. Empty-handed, he advanced among the boulders toward the waiting Hukks. The captain—Dalton was close enough to see his rank badge now—had pulled Brunt in front of him. The latter, aware of his role as a human shield, looked pale and damp. His mouth twitched as though there were things it wanted to say, but was having trouble finding words equal to the occasion.

When Dalton was twenty feet from the officer, passing between two six-foot-high splinters of up-ended rock, he halted abruptly. At once, the captain barked an order. There was a flicker of motion to Dalton's left. He darted a hand under his jacket, came out with the pistol, fired, and was facing the officer again as a yapping wail came from the target.

"Tell your troops to throw down their guns and pull back," Dalton said crisply.

"You call on *me* to surrender?" The officer was carefully keeping his members in Brunt's shadow.

"You've been had, Captain. Only three of your soldiers can bear on me here—and they have to expose themselves to fire. My reaction time is quicker than theirs."

"You bluff—"

"The gun in my hand will penetrate two inches of flint steel," Dalton said. "The man in front of you is a lot softer than armor."

"You would kill the man for whose freedom you offered your life?"

"What do you think?"

"My men surely will kill you!"

"Probably. But you won't be here to transmit the all-clear to the boys standing by off-planet."

"Then what do you hope to gain, Man?"

"Dalton's the name, Captain."

"That name is known to me. I am Ch'oova. I was with the Grand Armada at Van Doom's world."

"The Grand Armada fought well—but not quite well enough."

"True, Commodore. Perhaps our strategy has been at fault." The captain raised his head, barked an order. Hukk soldiers began rising from concealment, gun muzzles pointing at the ground; they cantered away toward the ship by twos and threes, their small hooves raising cottony puffs of dust.

When they were alone, Captain Ch'ooova tossed the rope aside.

"I think," he said, with a small, formal curtsy, "that we had best negotiate."

IX

"That fellow Ch'ooova told me something funny," Brunt said as the cargo carrier ploughed toward the dawn. "Seven years ago, at Van Doom's world, you were left in command of the Fleet after Admiral Hayle was hit. You were the one who brought the Grand Armada to a standstill."

"I took over from Hayle, yes."

"And won the battle. Funny, that part didn't get in the papers. But not so funny, maybe, at that. According to Ch'ooova, after the fighting was over, you refused a direct Admiralty order."

"Garbled transmission," Dalton said.

"Tempers run high in wartime," Brunt said. "The Hukks had made a lot of enemies before we finally faced up to going to war. The High

Command wanted a permanent solution. They gave you secret orders to accept the Hukks' surrender, and then blow them out of space. You said no."

"Not really; I just didn't get around to carrying out the order."

"And in a few days, cooler heads prevailed. But not before you were relieved and posted to the boon-docks, and your part in the victory covered up."

"Just a routine transfer," Dalton said.

"And then, by God, you turned around . . . you, the white-haired boy who'd saved the brass from making a blunder that would have ruined them when it got known—and went after the treaty hammer and tongs, to toughen it up! First you save the Hukks' necks—and then you break yourself trying to tighten the screws on them!"

Dalton shook his head. "Nope; I just didn't want to mislead them."

"You wanted their Armada broken up, occupation of their principal worlds, arms limitations with inspections—"

"Brunt, this night's work cost the lives of fourteen Hukk soldiers, most of them probably ordinary citizens who were drafted and sent out here all full of patriotic fervor. That was a dirty trick."

"What's that got to do—"

"We beat them once. Then we picked 'em up, dusted 'em off, and gave them back their toys. That wasn't fair to a straightforward

bunch of opportunists like the Hukk. It was an open invitation to blunder again. And unless they were slapped down quick, they'd keep on blundering in deeper—until they goaded us into building another fleet. And this time, there might not be enough pieces left to pick up."

Brunt sat staring thoughtfully out at the paling sky ahead; he laughed shortly. "When you went steaming out there with fire in your eye, I thought you were out for revenge on the Hukks for losing you your fat career. But you were just delivering a message."

"In terms that they could understand," Dalton said.

"You're a strange man, Commodore. For the second time, single-handed, you've stopped a war. And because you agreed with Ch'oova to keep the whole thing confidential, no one will ever know. Result: You'll be a laughingstock for your false alarm. And with your identity known, you're washed up in the junk business. Hell, Marston will have the police waiting to pick you up for everything from arms theft to spitting on the sidewalk! And you can't say a word in your own defense."

"It'll blow over."

"I could whisper a word in Marston's ear—"

"No, you won't, Brunt. And if

you do, I'll call you a liar. I gave Ch'oova my word; if this caper became public knowledge, it would kick the Hukks out of every Ter-ran market they've built up in the past six years."

"Looks like you've boxed yourself into a corner, Commodore," Brunt said softly.

"That's twice you've called me Commodore—Major."

Brunt made a surprised sound. Dalton gave him a one-sided smile.

"I can spot a hot-shot Intelligence type at half a mile. I used to wonder why they posted you out here."

"To keep an eye on you, Commodore, what else?"

"Me?"

"A man like you is an enigma. You had the brass worried. You didn't hew to any party line. But I think you've gotten the message across now—and not just to the Hukks."

Dalton grunted.

"So I think I can assure that you won't need to look for a new place to start up your junk yard. I think the Navy needs you. It'll take some string pulling, but it can be done. Maybe not as a commodore—not for a while—but at least you'll have a deck under your feet. How does it sound?"

"I'll think about it," Dalton said. ■

P. Schuyler Miller

the reference library

THE RESURRECTION OF BUCK ROGERS

I was never a real Buck Rogers fan.

The two original novelettes about the Rip Van Winkle who slept from 1927 until 2419 were among the best new stories that Hugo Gernsback printed in the early *Amazing Stories*. Ace has them both—"Armageddon 2419 A.D." from August, 1928 and "The Airlords of Han" from March, 1929—combined in a single book under the former title (Ace No. 02935; 60¢). But no sooner had the first story appeared than John Flint Dille, president of the National Newspaper Syndicate of America, saw in it the germ of something new in adventure "comic" strips. He talked its author, Philip Francis Nowlan, into dropping the series and writing continuity for the strips. A newspaper cartoonist, Dick Calkins, handled the art work for most of

the thirty-eight years that "Buck Rogers in the 25th Century" continued in the nation's newspapers.

Now Dille's son, Robert C. Dille, has assembled a massive sample of the daily and Sunday strips published between 1929 and 1948: "The Collected Works of Buck Rogers in the 25th Century" (Chelsea House, New York; 1969; 376 + xxiii pages; \$12.50). Those preliminary pages are a nostalgic introduction by Ray Bradbury and an "autobiography" of Buck Rogers dating from 1932.

For your money you are getting a great deal more than you got in the handsome collection of "Flash Gordon" strips that Nostalgia Press published in 1967. You get—if I have counted correctly—1126 daily black-and-white strips and 64 Sunday pages in color compared with 142 Sunday pages—all

but one black-and-white—in the “Flash Gordon” book. I still prefer Flash Gordon.

Maybe I was too old for Buck Rogers; Ray Bradbury at nine was just about right. Maybe I’d been spoiled by reading *Amazing Stories*—by reading Nowlan’s two stories, in fact. But it was evident from the start that Calkins couldn’t draw, and that the attention to detail and real narrative ability that Nowlan had showed in his stories hadn’t carried over into the continuity of the strip. “Tom Swift” made better sense.

But there are “Buck Rogers” fans among you, so let me tell you what you get in this collection. It is in many ways a better sampling of the strip than you got in the “Flash Gordon” book.

You begin with an unbroken run of the first 278 daily strips, in which Buck awakes in the 25th Century and leads the Americans in their successful rebellion against the Mongol overlords. There is a short skip, and you pick up the story with Wilma’s first encounter with the Martian tiger men who are going to replace the Mongols as staff villains, in one form or another, for the rest of the book. After another skip of about half a year, you have another almost complete sequence in which Buck, Wilma, et al visit Atlantis. This is almost as long as the Mongol sequence: 234 strips.

I’ve been very glib up until now,

because Calkin numbered his strips in sequence in the early days. Somewhere between the end of the Atlantis bit—the only sequence in the book that does reach its end—and the beginning of a 193-strip Martian attack on Earth, seven years elapse. This sequence includes 32 Sunday pages in color.

The rest of the book is made up of shorter, incomplete sequences spread over nine more years: Martians invade Jupiter in 1942; they all tangle with Monkeymen on “Planet X” in 1943; they cope with “Atomites” on Mercury in 1946; and the series ends with a 32-page color duel on the Moon in 1947 and ‘48. The two color sequences run end-to-end without a break and are dropped in 80% of the way through the first — Mongol—sequence.

When the strips began, the Americans of 2429 A.D. were flying World War I planes—though they had antigravity, rocket guns, walkie-talkies, television, and a lot of other practical, solid stuff that were a feature of the original stories. The Mongols, and later the Tiger Men, were using standard model flying saucers—and I wonder whether our present model, which has been carrying people all over the universe, isn’t modeled on these Buck Rogers strips of 1929 and 1930, almost a generation earlier.

Later someone—perhaps Mr.

Dille?—seems to have persuaded Calkins to look over the competition. The WW I planes disappear, and we begin to get craft that are ringers for some Frank R. Paul was drawing and painting for *Amazing* and Elliott Dold for the short-lived *Miracle Stories*.

Calkins wasn't much worried about consistency. Dr. Huer, the good if nutty scientist of the strip, shows up in 1930 with a normalized skull and a bushy Einstein-type head of hair. When we see him again in 1938 he has a swollen egg-bald dome. The Martian Tiger Men start out with nice, round human ears and heads striped like watermelons . . . develop pointed ears and corrugated skulls by 1938 . . . and four years later, when they invade Jupiter, have ears like hound dogs. (This last lot may be World War II propaganda contributions: the Martians sound like devolved German-Japanese, and the Monkeymen of Planet X are precisely that. Buck and his pals go into battle with the Martians yelling "Remember Pearl Harbor!", though Buck started his long sleep nine years before Pearl and could hardly have remembered it.)

The "science"—which Nowlan had made plausible enough in his initial stories—becomes pure doubletalk. Though much is made of the threat of the vacuum in space, Buck's crew are using a falling barometer to warn them of space storms. Sound also carries

freely through the vacuum. There is a lot of running around in the open on the Moon, but the Martians gave it an atmosphere. Rocket ships jump from planet to planet in minutes.

Paul and Dold weren't the only ones to contribute unwittingly to the strip. In the 1943 sample Calkins is beginning to imitate Alex Raymond's weird monsters and his offbeat composition from the "Flash Gordon" strips. As early as 1930 everyone was breaking out with synthetic slang that I'll swear was inspired by "Doc" Smith: "all clicky," "oofah," "zeeping," "skrookoo," ugh! (I don't think even nine-year-olds ever used the stuff.)

Looking back—and I admit that I didn't see the strip as it was appearing—I wonder whether the success of this kind of stuff in the daily papers didn't have a lot to do with the kind of scienceless space opera that some authors wrote and some magazines printed back in the '30s and '40s. As with TV today, publishers tried to give the public "what it wanted." Fortunately, Astounding and a few others resisted the trend. Unfortunately, Hollywood didn't.

I still like "Flash Gordon." Alex Raymond could draw!

DUNE MESSIAH

By Frank Herbert • G. P. Putnam's Sons, New York • 1969 • 256 pp. • \$4.95

This sequel to "Dune" was serialized in *Galaxy* late in 1969. (Publication of the book was postponed a month until the serial ended—a courtesy which not all publishers have granted.) It is by no means in a class with the first book. *Dune*—the planet—was its hero, and you finished with the conviction that you had lived there. Paul Atreides, the superman, is the hero of this sequel and superman or not, he simply can't compete with a world.

I would not recommend that you read the book in snatches, though. What happens as the major social forces of Atreides's empire conspire to destroy him is far too complex, and has far too many second and third-order meanings for casual reading. The Bene Gesserit—the galaxy-wide women's guild which has conspired over the centuries to breed a superman, and finds itself with one they can't control. The Princess Irulan, wife but never empress. The mutant Guild of Steersmen who feel their way through space with powers granted them by the drug, "melange," distilled from the colossal sandworms of *Dune*. The Quizarate missionaries who have carried Paul's *jehad* so bloodily to other worlds. The Fremen whose desert symbiosis was the theme of "Dune." And—perhaps the most interesting feature of the new book—the Tleilaxu face dancers, master biologists who can take any shape and can

recreate live *gholas* from the dead.

The real theme of the book, though, is what Paul Atreides's vast powers do to him and to the people of his empire. It is the paradox of the messiah who can foresee the future so truly that he lets his knowledge rob him of the will and power to shape his fate. It explores, at one point, the thought that law destroys the civilization that creates it, by replacing morality and conscience with empty words that no one listens to.

If you haven't read "Dune," and can find the paperback, by all means read it first. There's enough story in "Dune Messiah" to carry a reader, but without the background you'll miss more than you find.

NEBULA AWARD STORIES FOUR

*Edited by Poul Anderson •
Doubleday & Co., Garden City,
N.Y. • 1969 • 236 pp. • \$5.95*

As is customary, this anthology reprints the winning short fiction—novella, novelette and short story—in the annual Nebula Award competition of the Science Fiction Writers of America. Then the book is filled out with some of the runners-up.

In this case, the awards were made last spring for stories published in 1968—the 1969 balloting may be complete when you read this. Anne McCaffrey's "Dragonrider," from *Analog*, was a well-

deserved best novella choice. Richard Wilson's winning novelette, "Mother to the World," and Kate Wilhelm's "The Planners," the best short story, were both in Damon Knight's anthology of original stories, "Orbit 3." The fillers are Terry Carr's strange "The Dance of the Changer and the Three" from the "New World" anthology edited by Harlan Ellison, "The Farthest Reaches"—now out in three volumes in paperback—and two from *Galaxy*, H. H. Hollis's "Sword Game" and James E. Gunn's "The Listeners."

Most of these stories either have been or will be in other anthologies. If you missed "Dragonrider," it's part of the paperback novel, "Dragonflight," probably the best Analog novel since "Dune." Wilson's story is a moving "last man" story . . . but this time there is also a last woman, and she is lovable but feeble-minded. "The Planners" is one of the stories about molecular biology that John Campbell asked for at the Washington SF Convention in 1963 . . . RNA used to increase the intelligence of chimpanzees magically, but not magical enough to help a subnormal boy.

Hollis's "Sword Game" is the kind of comedy of mathematics that "Lewis Padgett" and Sprague de Camp used to write when Analog was Astounding. A topologist discovers a way to make money out of math with a Klein

bottle act involving a beautiful but dumb assistant. When he is fed up with her, he thinks of a way out. But.

Gunn's "The Listeners" demonstrates that old school masters can handle the "New Wave" techniques forcefully. It is the "straight" story of the team who have been listening for voices out of space, and what their seemingly hopeless vigil has done to their lives. I'd rate it higher than Wilson's winner, if that was the class in which it was rated.

And "The Dance"? It's practically indescribable—an attempt to see an utterly alien life form in its own terms. Everyone has to try it, but few have succeeded as well as Terry Carr in this.

THE POLLINATORS OF EDEN

By John Boyd • Weybright & Talley, New York • 1969 • 212 pp. • \$5.50

John Boyd's second SF novel is just as good as his "Last Starship from Earth," and totally different. It is a book that should please and exasperate Philip José Farmer, in that it has a legitimate sexual theme and handles it better than he has done himself in any of his recent books. Its scientific premise—which is the "secret" revealed in the last chapters, and hence not to be disclosed here—may be totally untenable, but science fiction has swallowed worse.

I also admit doubts about the

book's taxonomy. Even after nearly a century and a half, I can't see a biologist putting the utterly alien "tulips" of another planet into the same genus as earthly tulips, even though they look alike. I can't find "cystology" in my dictionary either, but it sounds like a good name for a science of seeds, and that fits Dr. Freda Caron's specialty very well. After all, who ever heard of sciences called dendrochronology or palynology or ecology even fifty years ago? The future will create its own new sciences.

This is a book about the terribly strange, highly evolved plants of another planet—yet, defying all formulas, we don't see that planet until the closing chapters. It is a book about the thawing of beautiful, brilliant, frigid Dr. Freda Caron . . . in normal sexual ways, and in a way that nobody could anticipate. It is a book that dissects the office politics of bureaucracy in a wholly delightful way, and makes that snake pit a vital element in its plot. And, as a good SF novel should, it slowly unravels the true nature of the strange talking "tulips" which Dr. Caron's fiancée has sent her from Flora, a world of flowers. They can train wasps to pollinate them—or to attack an enemy. They can plant their seeds in a ballistically controlled pattern. They can sing, make wonderful music, and use high-frequency sound to talk—or

to kill. And the orchids of Flora, which Paul Theaston has remained to study, are evolved far beyond the level of the tulips. Small wonder Freda Caron fights for a place on the expedition that may rescue him . . . only to find that he does not need rescuing in any sense she could have imagined.

The book would be a treat for its picture of intra- and interagency intrigue alone. It gives you much, much more . . . enough to make it a worthy candidate for the next round of "best novel" awards.

Reprints

THE PLANET BUYER

By Cordwainer Smith • Pyramid Books, N.Y. • No. X-2049 • 156 pp. • 60¢

A reissue of the first part of the adventures of Rod McBan, the boy from Norstilia who bought the Earth, met C'mell, challenged the Space Lords of the Instrumentality. The rest of his story is in "The Underpeople" (Pyramid X-1910). Read them both.

PLAYER PIANO

By Kurt Vonnegut, Jr. • Avon Books, N.Y. • No. NS-16 • 320 pp. • 95¢

Vonnegut is an "in" writer with the literati, the hippies—and the people who have enjoyed his satire all along. This was his first, "straightest," and maybe his best book. Long may he rave.

CYCLE OF FIRE

*By Hal Clement • Ballantine Books
• No. 70007 • 185 pp. • 50¢*

MISSION OF GRAVITY

*By Hal Clement • Pyramid Books
• No. T-2063 • 174 pp. • 75¢*

"Mission of Gravity" is, of course, perhaps the greatest "hard" SF story ever written. "Cycle of Fire," here reissued as a Bal-Hi paperback for school use, shows us a human being through the eyes of a very strange alien.

WATCH THE NORTHWIND RISE

*By Robert Graves • Avon Books
• No. V-2296 • 256 pp. • 75¢*

The rich and strange novel, by a leading poet, about a future based on the society and mythology of Minoan Crete.

FAHRENHEIT 451

By Ray Bradbury • Ballantine Books • No. 01636 • 147 pp. • 75¢

Bradbury's only real science-fiction novel, which the film should have followed more closely.

CONJURE WIFE

By Fritz Leiber • Award Books • No. A-341-X • 188 pp. • 60¢

GATHER, DARKNESS

*By Fritz Leiber • Pyramid Books
• No. X-1976 • 189 pp. • 60¢*

Two more grand stories which make the assumption that the phenomena of magic and witchcraft are real. "Conjure Wife" gives us witches in a modern university. (It was written long before the pres-

ent possession by demons.) "Gather, Darkness!" takes us to a future in which science has degenerated to a religion—to magic—and is overthrown by rational witches.

MORE THAN HUMAN

By Theodore Sturgeon • Ballantine Books • No. 72009 • 188 pp. • 75¢

You could get a good many signatures to a petition naming this the greatest modern science-fiction novel. Certainly it is Sturgeon's finest.

THE DYING EARTH

By Jack Vance • Lancer Books • No. 74-547 • 160 pp. • 75¢

These Dunsany-like stories of a far, far future were first published in 1950 in a rare paperback edition which very few stores carried. They tread a knife-edge between science fiction and fantasy, showing us an utterly strange world in which science is dimly remembered as magic, monsters have been born or migrated to a withered Earth, but men stubbornly live on. Vance has tried to duplicate these stories in the last few years, but has gone too far over into fantasy.

THE HUMANIDS

*By Jack Williamson • Lancer Books
• No. 74-519 • 178 pp. • 75¢*

Reissue of another classic which was even better in the two original serials in Astounding. Reread it with the Welfare State controversy in mind—then remember that this dates from 1948 and '49.

brass tacks

Dear Mr. Campbell:

There has been no mention lately of the fireballs associated with thunderstorms. This is rather a pity as it looked for a while as though the whole topic was going to get a public airing. The trouble seems to be that no professional scientist is going to risk his reputation by theorizing about a subject regarded, until recently, as folklore. You know the attitude. "Perhaps, if we ignore it, it'll go away".

This seems to be a case for the reasonably well informed amateur so, as I've no reputation to lose, may I be allowed to advance a theory? It presupposes four conditions, three of which demonstrably exist in thunderclouds. The fourth might possibly be a property of plasmoids under certain extreme conditions of field and temperature. I can't find any literature to refute it, but, on the other hand, neither is it mentioned even as a possibility. The conditions are as follows.

1. Strong updraughts and lateral

winds capable of vectoring an intense local whirlwind.

2. Copious quantities of water, preferably slightly acidic with oxides of nitrogen.

3. Gigawatt discharges.

4. Having established an appearance of sanity I'll leave this one until the method of fireball formation is described!

Imagine that a whirlwind is formed in a thundercloud. A mildly acid solution is drawn into this so that it becomes a liquid coil. Even if the coil isn't continuous it still presents a path of least electrical resistance. If a flash of lightning occurs near this coil, at least some of the current is sure to travel along these conducting paths.

This solenoid is now a magnet and the ends, having opposite polarity, are drawn together. While this is happening the water is flashed into plasma and the "coil" ends up as a spherical plasmoid contained by the magnetic field generated by the peripheral current.

Well, this might explain the formation of the fireball but how can it continue its existence? This is where condition Four comes in. Suppose, just suppose, that under certain conditions of high field, pressure and temperature a plasma becomes not merely a good conductor but a superconductor.

In this case the current would continue to circle the periphery of

the plasmoid. In effect it would become a self maintained and containing superconductive plasmoid magnet. As it fell to earth it would lose energy at least by radiation. This would cool the outer plasma which would cease to be superconducting. Heat formed by resistance would raise it once more to a superconductive state. Finally, a point would be reached at which the available current no longer would be able to maintain this state. When this happened the plasma would expand explosively into hot gas. More energy would be released as single atoms formed molecules and more again as these combined to form steam and nitrogen oxides.

Are there any data to support this theory? I think there are but you must judge for yourself.

Item: Fireballs drop down the spectrum in color as they age.

Item: They generally end explosively.

Item: They expire with a smell of brimstone. Ever *tasted* nitrogen peroxide?

Item: They have a habit of following buried pipes and wires hidden in walls. This is at least faintly analogous to the self levitation of superconductive magnets over a conductor.

But every theory should be capable of demonstration and reproducibility. Could thunderclouds be seeded with easily ionized elements? One idea which might work

would also extend the use of that old Van der Graaff generator in the basement. Why not create a whirlwind between the poles and feed in some cesium?

At any rate there must be some phoenix reaction researchers among your readers. Has any of them got any non-classified information on plasma characteristics which could throw some light on their conductivity?

DENNIS DAVIES

57, Clarence Embankment
Docks, Cardiff, Wales

That plasmoid would have to be a bit more complex than a simple sphere! And phoenix reaction experiments so far show that plasmas last micro- or milliseconds at best, even with complex magnetic geometries!

Dear Mr. Campbell:

This is a letter of appreciation for your editorial in the October issue. I have never seen the problem expressed more clearly or better.

Here in Alaska, we are in the process of extinguishing the Eskimos and Indians because differences in kind are seen to be irrelevant and superficial. Immoral perhaps, or a reflection of "inborn stupidity," but not important enough to deal with.

So, we get kids in school, test them with standard Metropolitan Achievement tests; give them "Dick and Jane" to read; fail to

comprehend that, for instance, a difference in sensing time is a basic thing with many ramifications, and then dismiss the people as being pretty dumb when they don't quite make it through school. Or end up drunks. Or in the mental hospital.

It's pretty depressing to watch the process in action, and here it is fairly easy to see since most of the old tribal mechanisms are still visible.

The premises on which the old cultures were based were different from our own and it required a different world view; a different set of values to survive. Eskimos think about time as time-to-do-something, like hunt caribou. And duration is also measured the same way. If it takes three days to bring in the whale, so it does. Once the work is done, then everybody collapses and rests up for the next thing. A different rhythm, which produces endless trouble when you put such a man into a six-day week, forty-eight hours or else.

Eskimos are also group people. Instead of individuals in our sense. They used to hunt and travel in groups and there are quite a few mechanisms designed to facilitate that idea. Infants live in close body contact with mother or baby sitter in the hood, sleep with somebody, are constantly handled: ergo, being close to somebody is nice. Competition is discouraged in the group: the ideal is somebody who can get along with everybody, so

there won't be fights and trouble when you're way out some place and dependent only on yourselves. So teachers have found out they can't say to little Joe Okpik, "Why don't you study hard like Pete Ahvik, and get all A's like he does?" Joe Okpik instantly stops studying even as hard as he was, and Pete Ahvik is apt to do the same because it's bad to be singled out.

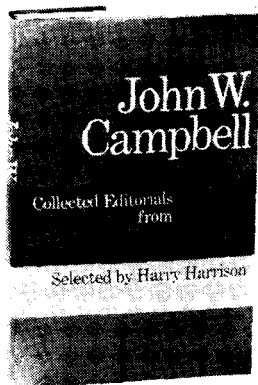
There are a number of other things along these lines: Eskimos dichotomize between past/present and future. The future is kind of unclear and shadowy, as is proper when you never know what the next bend of the river's going to bring. You might as well not worry about it, but relax and take it easy, and cope with what comes when it comes. And so on.

You try to stuff people like that into standard American classrooms and you get nothing but disaster. It is endlessly difficult, and there are so many losses; people who end up just drifting. The things they learned at home are different from attitudes they must have to make it in the modern world, but for some reason it's not considered right to point this out, or to explain these underlying differences.

Perhaps, as you point out, because to our way of thinking, difference always involves a value judgment: superior/inferior.

You have only to travel with Eskimos as I have done, to recognize the survival value of the Eskimo

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viewpoint—and that it is different in kind.

JANE PENDER

Box 91

Kotzebue, Alaska 99752

Moreover, Eskimos are spectacularly gifted with respect to understanding mechanisms—they repeatedly demonstrate extremely high intelligence with respect to real-world things. Example: An Eskimo, hired by builders of the Dew Line radar station in northern Alaska, had heard of, but never before encountered white men and/or English. Two years later he was elected Shop Steward in the Machinists' Union at the station. He'd not only learned to read and write and speak English, he also read blue-

prints, and made machine-tool equipment sing symphonies!

But they have trouble passing grade school tests!

Dear John:

As one of the designers of the Apollo 11 television cameras I thank you for the kind words in your November editorial. However, I must refute the statement about the batteries and the mouse-powered transmitter. Both the black and white camera on the LM and the color camera in the Command Module receive their power and supply video via a four-wire cable. The video is then FM-modulated in the spacecrafts for telemetry to Earth.

Brass Tacks

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I might add that we have every hope that Apollo 12 will have color from both the command module and from the lunar surface, but that we still have not found a way to improve the lighting.

FRED SCHAFF

8918 Chapel Avenue
Ellicott City, Md. 21043

I believe in giving honor where honor is earned!

And thanks for the data.

Dear Mr. Campbell:

After reading your little comment about the subtleties of the English language on page 67 of November 1969 *Analog*, I thought you might be interested in this gem culled from the pages of the October 2, 1969 University of Rochester *Journal*. The context is the reporting of an SDS meeting:

U. R. JOURNAL October 2, 1969
Published weekly by the students of
The University of Rochester.

As the converted cafeteria filled the meeting did begin. The first order of business was a speech delivered by the President of the campus SDS (?) This was to the uninitiated listener a rather emotional experience. For in the course of his monologue he managed to touch upon those basic ideals which the process of American education had ingrained upon my view of current political belief and criticism.

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"... We want a fullsome democracy," was his basic assertion as he sought gallantly to criticize those general areas of popular disapproval. The "big four" include: militarism, environmental deterioration, racism, and pseudopatriotism.

The speaker did not know how appropriate his choice of an adjective describing democracy was—democracies have invariably turned out to be some of the most fulsome of governments. Presumably the speaker quoted must have desired to convey a good image of the system he advocated, but "fulsome" is not the word to use in such a description. Perhaps if the demagogue quoted had spent more time studying and less time organizing for student "power" he would have a less error-prone command of the English language.

CARL T. HELMERS, JR.

Box 5043
River Campus Station
Rochester, New York 14627
Maybe he meant that "fulsome" to apply to the "Democracy" in SDS?

Dear Mr. Campbell:

Concerning the "sweat through" spacesuit: how does the following design impress you?

Regular permeable canvas G suit for arms and legs. When worn the wearer inflates bags, or tubes, to tighten the cloth hard against the skin.

Re chest, abdomen, breathing

Analog Science Fiction / Science Fact

and pressure volume considerations:

As Dr. W. C. Kaufman pointed out, the pressure volume relations of the thorax demand, in the long run, an externally pressurized area about the chest; that is normal breathing without having air forced into the lungs under pressure.

I think I see a feasible way of doing this, and sweating into vacuum at the same time. Encase the chest and abdomen in a canvas suit larger, by an inch or so, than the chest at maximum expansion and place in this inflexible restraining chamber some rubber impregnated—air tight—bags connecting directly to the helmet.

When the man inhales his chest expands emptying the bags of air into the helmet; this proceeds naturally on into the lungs. When he exhales, the air leaves his lungs—his chest shrinks—enters his helmet—via nose or mouth—and then goes down tubes to the bags between chest and the restraining outer suit.

Since the outer canvas suit is a constant volume affair when the chest expands, the bags between chest and suit are deflated by an amount exactly equal to the inflation of the lungs.

The neck region is the problem and a seal is required since the helmet space is contiguous not only with the bags, but also with the outer vacuum by way of a thin

space between bags and the astronaut's skin. (How fast would leakage be between a two-inch band of rubber and a man's skin across the upper chest and neck shoulders?)

There would certainly need to be some seal between the bag surface and the upper chest, shoulders and back of the astronaut. This seal might be held in place by a form-fitting constricting band of some stretch material (Lycra-Spandex?) or by a pneumatic tube.

Water evaporating from lower chest and abdomen sweat glands could rapidly flow through pore spaces of a knit undershirt, around the rubberized bags, through the canvas outer suit and on into vacuum. While on a macroscopic level, the bags pressing on chest—through the undershirt—would maintain whatever pressure was desired against both inside and outside of chest cavity. Thus normal breathing conditions are maintained for the astronaut.

Certainly the breathing movements could be used to circulate the air through the air purification system and O_2 conc. controls.

I have expressed myself in more detail than necessary. Do you see any reason why it would not work?

DAVID LOBDELL, BOTANIST
P.O. Box 441
Pisgah Forest, N. C. 28768
Interesting—but that tourniquet effect around the neck might cause serious discomfort.

RED TIDE

continued from page 7

Meanwhile, back at the farm, even the farms in Asia, changes are being made. For the first time in history, southeast Asia has a surplus of rice for export this year—so much so, it's worrying a lot of Asian governments. Japan's got the stuff overloading their storage facilities, and now that they have a lot to export—they can't because everybody else in the area has, too!

That's thanks to the Philippine development of the new super-high-producing strain of rice called IR-8. It yields three to four times as much rice per acre.

If, that is, the fields are fertilized properly. Phosphates and nitrates are needed, naturally, as the old strains didn't . . .

O.K., so we have a technology that produces more food so we can breed more people.

But it is also destroying the ecology of the planet.

Conservationists howling about phosphates destroying fish in streams and lakes may possibly get away with attacking Mama's highly effective detergents, and forcing her back to second-rate detergents. But what chance do they have of making the agricultural industry stop using fertilizers? And still feed the human "red tide," that is.

Moreover, note that producing those phosphates and nitrates requires immense quantities of energy for mining, transporting, grinding, processing, and reducing the phosphate rock. That rock is stubborn enough to make it practical to recover the phosphorus needed by breaking it loose as elemental phosphorus in electric furnaces. It takes *energy* to break the insoluble and chemically unavailable phosphate rock down to compounds that plants can use.

Now there's nothing wrong with automobiles; they didn't cause any pollution problems for years and years. An automobile still isn't a serious pollution problem. *An* automobile. It's the 90,000,000 or so metal monsters that constitute the largest source of atmospheric pollution.

Currently California has the most stringent laws on automobile pollution controls; new cars sold in that state have to have reasonably effective pollution-control devices installed.

But as every California driver knows, *an* automobile isn't going to cause any trouble. And the pollution-control devices slightly decrease the efficiency of the engine, somewhat reducing maximum power output and gas mileage. And they have to be maintained, of course, and the engine adjusted, or the device is, presently, practically useless.

So quite a few annoyed car

owners have simply removed the devices from their own cars. After all, they know perfectly well that one automobile isn't dangerous, and "Mine's only one."

O.K., friends—is that a typically human reaction?

And the current widely popular philosophy of the young that no man should be forced to do anything he doesn't want to means that such rejection of pollution control is perfectly proper and moral, doesn't it?

This makes it much more popular to attack the great, greedy, villainous Power Industry, because electric power plants are second only to the automobile as pollution sources. Few other industries even approach the electric power companies as atmosphere polluters.

Yeah, sure—because the others are all buying their energy from the power companies, thereby not having to use fuels themselves. Like the phosphate producers that use electric furnaces to reduce phosphorus. See, it's the power industry that makes all that pollution!

Incidentally, I saw Walter Cronkite, on CBS TV fall for a propaganda gag that was a honey. Somebody had told him that sulfur dioxide in air gradually turns to sulfuric acid. And that all living things contained sugar. "And now," said Cronkite, "watch what sulfuric acid does to sugar," and

somebody in a white lab coat poured some sulfuric acid onto some sugar in a beaker.

As any chemist knows, the result was a fizzing and bubbling, and the sugar rapidly turned into a horrible mess of jet-black foam.

Spectacular—but somebody was pulling a propaganda hoax on Cronkite; that was totally irrelevant to the problem of pollution. Cronkite would have been a better reporter if he'd inquired a little more into what was going on.

It's based on the fact that pure sulfuric acid— H_2SO_4 —is one of the most fantastically active dehydrating agents around. It has a ferocious hunger for water; it'll yank it out of chemical combination even, to get H_2O to produce the hydrated form $H_2SO_4 \cdot H_2O$ —plus a lot of heat. Drop pure H_2SO_4 into water, and each drop hisses like a hot iron because of that powerful hydration reaction.

Sugar, as a carbo-hydrate, falls into the general formula $C_n H_{2n} O_n$ —carbon plus water. Sulfuric acid simply grabs the water loose, and leaves the carbon as a black foamy mass.

To do this, the sulfuric acid has to be very forcefully pried loose from the water it normally has with it. Battery acid, for instance, won't do any such trick—it already has a decent amount of water.

And sulfuric acid in the air satisfies its needs by absorbing hu-

midity to make a very dilute solution.

It might be interesting to show what happens to living cells when there was no "sulfuric acid" around. Since all living tissues must have some sulfur containing amino acids, an organism totally deprived of sulfur sources would obviously die. This proves sulfuric acid is good for you?

Pollution is a real problem, with no simple solutions. Cheap propaganda tricks, such as that Cronkite presented, are no help; they confuse the issue—and it definitely doesn't need any more confusion than is inherent in it.

It doesn't need the confusion produced by attacking the power companies that are burning fuels efficiently so that thousands of other industrial plants won't have to burn them inefficiently.

And recognize that if really good electric batteries are developed, and good electric cars become available—the power plants will immediately be the Number One Producers of Pollution. They'll be burning the fuel to produce the electricity stored in your pollution-free automobile. Then people can *really* scream about those awful power plants.

As a matter of fact, the pressure currently to make power companies use fossil fuel plants, not nuclear plants, is a magnificent example of misdirected high-minded idealistic Conservation.

Fossil fuels release carbon dioxide and monoxide into the atmosphere—as well as the sulfur the living organisms needed in their life processes, before they were fossilized—and they therefore directly affect the biosphere. The huge tonnage of CO₂ can have some interesting effects on climate—though meteorologists and climatologists, as of now, don't know enough to predict whether it'll bring on an ice age, or lead to melting the glaciers we now have. They're pretty certain that it will do something.

The only type of energy source that does not have to interact massively with the biosphere is nuclear energy. Hydroelectric power . . . ? Oh, but remember what dams can do to change the ecology of a region! Of course, if you can find an adequate natural cataract—a Niagara Falls, or Victoria Falls—in a convenient location . . . but then, people don't want the beautiful Niagara Falls turned off just to keep their air conditioners running, do they?

The whole thing, complex as it is, boils down to a simple proposition.

We can solve the whole sticky problem by getting rid of about eighty percent of the human population of the planet.

Earth is suffering from a "red tide" of human population explosion.

See how simple the solution really is? ■ The Editor



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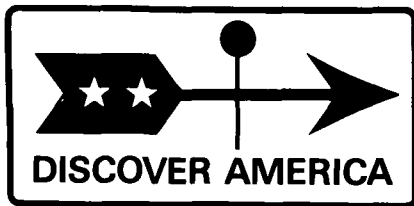
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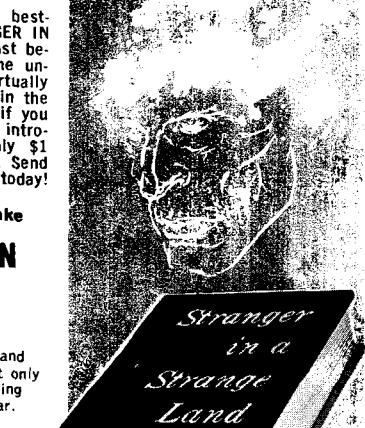
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